CONNECTICUT RIVER BASIN

MASTER MANUAL OF RESERVOIR REGULATION

APPENDIX E
ASHUELOT RIVER WATERSHED

NEW HAMPSHIRE

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.

FEBRUARY 1962

CONNECTICUT RIVER FLOOD CONTROL

MASTER MANUAL

OF

RESERVOIR REGULATION

APPENDIX	WATERSHED	RESERVOIRS
A.	OMPOMPANOOSUC RIVER	UNION VILLAGE
B.	OTTAUQUECHEE RIVER	NORTH HARTLAND
C.	BLACK RIVER	NORTH SPRINGFIELD
D.	WEST RIVER	BALL MOUNTAIN TOWNSHEND
E.	ASHUELOT RIVER	SURRY MOUNTAIN OTTER BROOK
F.	MILLERS RIVER	BIRCH HILL TULLY
G.	CHICOPEE RIVER	BARRE FALLS CONANT BROOK
H.	WESTFIELD RIVER	KNIGHTVILLE LITTLEVILLE
I.	FARMINGTON RIVER	MAD RIVER

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Department of the Army
Corps of Engineers
Office of the Division Engineer
New England Division
Waltham, Massachusetts

February 1962

MASTER MANUAL OF RESERVOIR REGULATION

ASHUELOT RIVER WATERSHED

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SURRY MT. RESERVOIR
AREA AND CAPACITY

DRAINAGE AREA = 100 S.M.

ELEV. M.S.L.	STAGE FEET	AREA ACRES	CAPACITY AC. FT.	CAPACITY INCHES
485	0	0		
486	1	15	5	
487	2	30	12	
488	3	40	22	
489	4	55	32	
490	5	70	42	
491	6	85	62	.01
492	7	100	92	.02
493	8	120	132	.03
494	9	140	243	.05
495	10	155	383	.07
496	11	175	500	.09
497	12	195	700	.13
498	13	215	900	.17
499	14	240	1105	.21
499.5	14.5	250	1200	.23
500	15	260	1317	.25
	RECREATION POOL - 500'			
501	16	278	269	.05
502	17	296	559	.10
503	18	314	864	.16
504	19	332	1187	.22
505	20	350	1528	.29
506	21	364	1885	.35
507	22	378	2256	.42
508	23	392	2641	.49
509	24	407	3041	.57
510	25	423	3456	.65
511	26	438	3887	.73
512	27	453	4333	.81
513	28	468	4794	.90
514	29	483	5270	.99
515	30	498	5761	1.08
516	31	512	6266	1.17
517	32	526	6785	1.27
518	33	540	7318	1.37
519	34	554	7865	1.47
520	35	567	8426	1.58
521	36	580	8999	1.69
522	37	594	9586	1.80
523	38	608	10187	1.91
524	39	621	10802	2.02
525	40	635	11430	2.14
526	41	649	12072	2.26
527	42	664	12729	2.39
528	43	678	13400	2.51
529	44	693	14086	2.64
530	45	708	14786	2.77
531	46	722	15501	2.90
532	47	736	16230	3.04
533	48	750	16973	3.18
534	49	765	17731	3.32
535	50	780	18503	3.47
536	51	794	19290	3.61
537	52	808	20091	3.77
538	53	822	20906	3.92
539	54	836	21735	4.07
540	55	850	22578	4.23
541	56	862	23434	4.39
542	57	874	24302	4.55
543	58	887	25183	4.72
544	59	900	26076	4.89
545	60	913	26983	5.06
546	61	925	27902	5.23
547	62	937	28833	5.40
548	63	948	29776	5.58
549	64	959	30729	5.76
550	65	970	31694	5.94
	CREST ELEVATION - 550'			
551	66	986	32672	6.12
552	67	1002	33666	6.31
553	68	1018	34676	6.50
554	69	1034	35702	6.69
555	70	1050	36744	6.89
556	71	1067	37802	7.08
557	72	1084	38878	7.29
558	73	1100	39970	7.49

PLATE NO.E-16

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LIST OF PLATES

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Spillway Design Flood - Otter Brook Reservoir	E-45
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ASHUELOT RIVER WATERSHED

PERTINENT DATA

LOCATIONS

The Ashuelot River is a tributary of the Connecticut River and located in the southwest corner of New Hampshire.

a. Surry Mountain Dam. - Town of Surry, New Hampshire, on the Ashuelot River about 5 miles northwest of Keene, New Hampshire and about 34.6 miles above the confluence of the Ashuelot and Connecticut Rivers.

b. Otter Brook Dam. - City of Keene, New Hampshire, on Otter Brook, a tributary of The Branch which in turn, is a tributary of the Ashuelot River. The dam is 4.9 miles above the confluence of The Branch and the Ashuelot River.

TYPE AND PURPOSE OF PROJECTS

Both reservoirs are flood control projects. Their purpose is primarily to provide flood protection for the community of Keene and secondly to protect other downstream communities on the Ashuelot and Connecticut Rivers.

AUTHORITY

a. Surry Mountain. - Flood Control Act approved June 22, 1936(Public Law No. 738, 74th Congress), as amended by Public Law No. 111, 75th Congress approved May 25, 1937.

b. Otter Brook. - Flood Control Act approved 3 September 1954.

DRAINAGE AREAS	SQUARE MILES
Ashuelot River at Gilsum(USGS Gage)	71
Ashuelot River at Surry Mt. Dam	100
South Branch at Webb(USGS Gage)	36
Ashuelot River at Hinsdale(USGS Gage)	420
Otter Brook at Dam	47

FLOODS OF RECORD

Ashuelot River near Gilsum, N.H.		Otter Brook near Keene, N.H.	
Date	Discharge	Date	Discharge
Sept 21, 1938	5220 c.f.s.	Sept 21, 1938	6130 c.f.s.
March 18, 1936	4400 c.f.s.	Oct 24-25, 1959	5000 c.f.s.
Nov 26, 1950	3700 c.f.s.	March 18, 1936	3580 c.f.s.

SPILLWAY DESIGN FLOOD DATA

	Surry Mountain	Otter Brook
Total rainfall - inches	22.2	24.8
Infiltration rate - inches per hour	.067	.067
Total runoff - inches	19.6	21.2
Maximum reservoir inflow - c.f.s.	63,000	38,000
Maximum reservoir outflow - c.f.s.	54,000	34,500
Maximum surcharge - feet	12.4	16.1
Freeboard	5.6	4.9

RESERVOIRS

a. Surry Mountain

Location	Elevation m.s.l.	Stage feet	Area Acres	Capacity Acre Feet	Capacity Inches on Drainage Area
Streambed at Dam	482.0	-	-	-	-
Inlet Elevation	485.0	0	0	-	-
Recreation Pool	500	15	260	1,317	0.25
Spillway Crest	550.0	65.0	970	31,300(net)	5.9(net)
Maximum Surcharge	562.4	77.4	1195	45,100(net)	8.5(net)
Top of Dam	568.0	83.0	1350	50,000(net)	9.4(net)

b. Otter Brook

Location	Elevation m.s.l.	Stage Feet	Area Acres	Capacity Acre Feet	Capacity Inches on Drainage Area
Streambed at Dam	669.0	-	-	-	-
Inlet Elevation	683.0	0	12	0	0
Recreation Pool	701.0	18.0	70	720	0.3
Spillway Crest	781.0	98.0	374	17,600(net)	7.0(net)
Maximum Surcharge	797.1	114.1	444	24,100(net)	9.6(net)
Top of Dam	802.0	119.0	468	25,600(net)	10.2(net

DAMS	Surry Mountain	Otter Brook
Type	Rolled Earth Fill	Rolled Earth Fill
Length-feet	1800	1288
Top Width - feet	30	25
Top of Dam - m.s.l.	568	802

OUTLET WORKS

a. Conduits

	Surry Mountain	Otter Brook
Number	One	One
Shape	Boston Horsehoe	Boston Horseshoe
Size	10' diameter	6' diameter
Length - feet	383	589
Invert elevation at Portal - m.s.l.	484.0	677.0

b. Gates

	Surry Mountain	Otter Brook
Number	Two	Three
Type	Broome	Hydraulic Slide
Size	4'6" x 10'	2'6" x 4'6"
Elev. Gate Sills - m.s.l.	484.66	683.0

c. Recreation Weir

	Surry Mountain*	Otter Brook
Type of structure	Concrete	Concrete weir w/stop logs
Location	Upstream of both gates	Entrance to center gate
Weir length-feet	25(approx.)	31.67(effective)
Stop logs	None	5 openings-6' deep by 6'4" wide
Crest stage - feet	14.5	15(stop log sill)
Recreation pool stage-feet	15	18
Manually operated gate	2'x3'	6" dia.

* To be built in 1962

OUTLET WORKS (Continued)

d. Stilling Basin

	Surry Mountain	Otter Brook
	None	Width - 25 ft Length of Floor Section- 35 ft. Floor Elevation, m.s.l.- 658.0 End Sill Crest Elevation- 662.0 Two rows of Baffles - $2\frac{1}{2}$' high

SPILLWAY

	Surry Mountain	Otter Brook
Type	Uncontrolled, ogee weir L-shaped side channel spillway	Uncontrolled, ogee weir and chute in rock
Crest length - feet	338	145
Crest elevation - m.s.l.	550.0	781.0

RECREATIONAL FACILITIES

	Surry Mountain	Otter Brook
Existing	11 picnic tables, 11 fireplaces, beach, 3 parking areas, boat ramp	50 picnic tables, 25 fireplaces, beach, 2 parking areas, 2 sanit. fac., launching ramp
Future	77 picnic tables, 34 fireplaces, water supply, 2 sanit. fac., parking area	35 picnic tables, 25 fireplaces, water supply, comfort station, parking areas
Managed by	Corps of Engineers	State of New Hampshire (license)

COST

Total Estimated	$1,731,000	$4,000,000

QUANTITIES

	Surry Mountain	Otter Brook
Embankment Volume - c. y.	1,105,000	973,000
Concrete - c. y.	13,000	5,660

GUIDE TAKING LINES

	Surry Mountain	Otter Brook
Guide taking control line-elevation, m.s.l.	550	-
Fee-elevation, m.s.l.	-	755
Fee-acres	1688	461
Easement-elevation, m.s.l.	-	797
Easement-acres	18	152

CONSTRUCTION DATES

	Surry Mountain	Otter Brook
Start of Construction	Summer of 1939	October 1956
Placed in Operation	October 1941	April 1958
Completion of Construction	June 1942	September 1958

RESERVOIR REGULATION MANUAL

ASHUELOT RIVER WATERSHED

AUTHORIZATION AND SCOPE

1. Authority. - This report is prepared in accordance with instructions contained in ER 1110-2-240, par. 6.

2. Scope. - The purpose of this manual is basically to prescribe the regulations for the hydrologic reporting and the hydraulic operation of the Surry Mountain and Otter Brook Reservoirs during periods of normal and flood flows. This manual will serve as a guide and ready reference for the use of the Reservoir Regulation Section of the New England Division Office as well as for the Flood Control Dam Operators.

DESCRIPTION OF ASHUELOT RIVER WATERSHED

3. Ashuelot River. - The Ashuelot River lies in the southwest corner of New Hampshire where it drains an area of 421 square miles at its confluence with the Connecticut River near Hinsdale, N. H. (Plates No. E-3 and E-4). The river has a total fall of 1475 feet in its length of 64 miles, but much of this drop is concentrated near the headwaters (Plate No. E-5). Generally, the watershed is hilly with low mountains in the headwaters and a few natural lakes and ponds are also found in the area.

4. Main Tributaries. - The two main tributaries of the Ashuelot River are The Branch and the South Branch. The Branch enters the Ashuelot River just below Keene, N. H. about 26.5 miles upstream from the mouth of the Ashuelot River and is formed by the confluence of Otter Brook and Minnewawa Brook. The South Branch joins the Ashuelot River just above Swanzey Station, about 23.5 miles upstream from the mouth.

5. Keene Flood Plain. - Discharges from the main river and the two principal tributaries, The Branch and the South Branch, converge in a flood plain just below Keene, N. H. (Plates No. E-5 and E-6). The flood plain extends from the Faulkner and Colony Dam in Keene downstream to the Homestead Woolen Company Dam in West Swanzey. The upper end of the flood plain on the Ashuelot River, between the Faulkner and Colony Dam and the mouth of The Branch, is the critical damage area in Keene. (See paragraphs 28-31 for a discussion of the flood plain).

ECONOMIC DEVELOPMENT IN THE ASHUELOT RIVER WATERSHED

6. General. - The city of Keene and the 15 towns within the Ashuelot River Watershed experienced a population growth of 11% between 1940 (25,300) and 1950 (28,200), and another 11% between 1950 and 1960 (31,500). The city of Keene, comprising 50% of the population in the watershed, and the adjoining town of Swanzey, comprising 10% of the population, have experienced 80% of this growth. During the same period the commercial and industrial segment of Keene, which is the business center of southwestern New Hampshire, has undergone a corresponding expansion. New industries have moved into the area and existing establishments have increased their facilities.

FLOOD LOSSES

7. General. - The September 1938 flood was the greatest and most damaging flood of record in the Ashuelot River Watershed. The Keene area was the hardest hit with experienced damages amounting to $515,000 or about 45% of the total losses in the watershed. The recurrence of 1938 flood stages in the Keene area would result in total damages of $3,200,000 at 1961 price levels. About $700,000 of the above damages would occur in the Ashuelot River area between the pumping station and the former Faulkner and Colony Dam upstream of West St. Damages to industrial establishments would comprise half of the total with remaining losses being distributed as follows: commercial 20%, residential 13%, railroad 10%, farms 3%, and highways and public buildings 4%. Plate No. E-7 shows the stage-damage relationships in this area.

8. Minor damages are experienced by railroad embankment and isolated residences at a stage 5 feet below the 1938 flood. At a stage of 4 feet below 1938, other houses, farm land and one industry are affected. With a rise to a stage 3 feet below 1938 other industries, commercial establishments and additional residences are affected.

DESCRIPTIONS OF SURRY MT. AND OTTER BROOK PROJECTS

9. Surry Mt. Dam. - The dam, completed in June 1942, is located in the town of Surry on the Ashuelot River about 34.6 miles above the confluence of the Ashuelot River with the Connecticut River. The reservoir, which is shown on Plate No. E-10, has a recreation pool with an area of 260 acres at elevation 500 feet, m.s.l. At spillway crest elevation 550 ft., m.s.l., the reservoir covers an area of 970 acres and has a total capacity of 32,615 acre-feet, equivalent to 6.1 inches of runoff from a drainage area of 100 sq. miles (Plate No. E-8). Deducting the capacity of the recreation pool results in a net flood control capacity of 31,300 acre-feet (Plates No. E-16 thru E-18), equivalent to 5.9 inches of runoff.

10. The dam is rolled earth fill about 1800 feet in length, with the top of dam at elevation 568.0 ft., m.s.l. An L-shaped side channel spillway includes a concrete ogee weir with a crest length of 338 feet (Plate No. E-11).

11. The outlet works (Plate No. E-12) consist of a 10' diameter horseshoe conduit 383 feet in length, with 2 Broome-type gates, 4'6"x10', with sills at elevation 484.66 ft., m.s.l.

12. Otter Brook Dam. - The dam, completed in 1958, is located on Otter Brook in the city of Keene. Otter Brook is a tributary of The Branch, which in turn is a tributary of the Ashuelot River. The reservoir, which is shown on Plate No. E-13, has a recreation pool with an area of 70 acres at elevation 701 ft., m.s.l. At spillway crest elevation 781 ft., m.s.l., the reservoir covers an area of 374 acres and has a total capacity of 18,320 acre-feet, equivalent to 7.3 inches of runoff from a drainage area of 47 sq. miles (Plate No. E-9). Deducting the capacity of the recreation pool results in a net flood control capacity of 17,600 acre-feet (Plates No. E-19 thru E-21), equivalent to 7.0 inches of runoff.

13. The dam consists of rolled earth fill about 1288 feet in length, with the top of dam at elevation 802 ft., m.s.l. The spillway (shown on Plate No. E-14) is a concrete ogee weir with a crest length of 145 feet, and a chute discharge channel in rock.

14. The outlet works (Plate No. E-15) consist of a 6' diameter horseshoe conduit, 589 feet in length and 3 hydraulic slide gates, 2'6"x4'6", with sill elevations at 683.0 ft., m.s.l.

OTHER FLOOD CONTROL PROJECTS IN THE WATERSHED

15. Ashuelot River Channel Improvement (C. of E.). - A clearing and snagging project in 1954 improved the channel of the Ashuelot River below Winchester St. in Keene allowing increased discharge from Surry Mt. Reservoir.

16. Honey Hill Dam (C. of E.). - The project was authorized August 18, 1941 but is now in an inactive status. The dam would be located on the South Branch of the Ashuelot River in the town of Swanzey about 5.6 miles upstream of its confluence with the Ashuelot River and would consist of an earth embankment of rolled-fill construction. The flood control capacity of the reservoir would be 26,200 acre-feet, equivalent to 7.0 inches of runoff from the drainage area of 70 square miles. With the reservoir filled to spillway crest (elev. 520.0 feet, m.s.l.), an area of 1,360 acres including part of East Swanzey would be inundated.

17. Beaver Brook Dam (C. of E.). - A survey report study was authorized by a resolution of the Senate Committee on Public Works on 3 October 1960. Present studies indicate that a flood control dam is economically more feasible and more beneficial than local flood protection works. The location of the proposed dam site on Beaver Brook is still under study and therefore the following data is provisional. The flood control capacity of the reservoir will be 3,200 acre-feet, equal to 10 inches of runoff from a drainage area of 6.0 square miles. An area of 230 acres is inundated at the spillway crest elevation of 810 feet, m.s.l.

18. Ash Swamp Brook (S.C.S.) - The Soil Conservation Service studied and was responsible for the administration of a Watershed Work Plan Agreement on the Ash Swamp Brook drainage area. The plan provides; a) for land treatment measures on both the flood plain and surrounding upland areas; b) structural and channel improvements, such as modifications of bridges, culverts, etc., widening of channels, construction of branch ditches, etc. As there is no provision for the impoundment of flows in this area, either now or in the future, these improvements have no effect on the regulation procedures of either reservoir. The work plan was completed in the latter part of 1961.

CLIMATOLOGY AND HYDROLOGY

19. General. - The Ashuelot River Watershed has a variable climate characterized by frequent but generally short periods of heavy precipitation. It lies in the path of the "prevailing westerlies" and is exposed to the cyclonic disturbances that cross the country from the west or southwest. The area is also subject to coastal storms that travel up the Atlantic seaboard in the form of hurricanes of tropical origin and storms of extra-tropical nature, often called "northeasters". The winters are moderately severe with sub-zero temperatures quite common. The spring melting of the winter snow cover occurs generally in late March or April.

20. Temperature. - The mean annual temperature at Keene, N. H., is approximately 45° F with the average monthly temperature varying from about 70° F in July to near 20° F in January. Extremes in temperature range from highs slightly in excess of 100° F to lows in the minus 'thirties'. Table E-1 gives the mean, maximum, and minimum monthly temperatures at Keene, N. H. for 67 years of record through 1960.

TABLE E-I

MONTHLY TEMPERATURES AT KEENE, N. H.

(Degrees Fahrenheit)

MONTH	MEAN	MAXIMUM	MINIMUM
January	21.2	66	-32
February	21.7	64	-32
March	32.0	85	-20
April	44.0	91	1
May	55.5	93	21
June	63.8	98	27
July	68.9	104	34
August	66.5	102	27
September	59.5	101	19
October	48.7	88	10
November	36.9	80	-15
December	24.9	63	-29
Annual	45.3	104	-32

21. Precipitation. - The mean annual precipitation at Keene is 38.65 inches. The greatest annual precipitation recorded was 51.20 inches in 1951 and the least annual amount was 27.12 inches recorded in 1894. Table E-II summarizes the precipitation record at Keene, N. H. for 68 years of record through 1960.

TABLE E-II

MONTHLY PRECIPITATION AT KEENE, N. H.
Elevation 490 Ft., M.S.L.
(Depth in Inches)

MONTH	MEAN	MAXIMUM	MINIMUM
January	2.93	6.50	0.85
February	2.69	7.02	0.60
March	3.24	7.60	0.40
April	3.15	6.65	0.35
May	3.13	7.02	0.79
June	3.26	7.73	0.41
July	3.75	11.09	1.07
August	3.82	8.96	1.05
September	3.66	10.39	0.20
October	2.82	7.84	0.23
November	3.16	7.67	0.52
December	3.01	6.70	0.51
Annual	38.65	51.20	27.12

22. Snow. - Monthly and annual average snowfall at Keene, N. H. for 65 years of record through 1960 are shown in Table E-III below.

TABLE E-III

MEAN MONTHLY SNOWFALL AT KEENE, N. H.
(Depth in Inches)

MONTH	ELEV. 500 FT., M.S.L.
January	16.4
February	15.9
March	11.0
April	3.4
May	-
June	-
July	-
August	-
September	-
October	0.1
November	3.8
December	10.8
Annual	61.4

RUNOFF

23. Discharge Records. - There are five U. S. Geological Survey gaging stations in the Ashuelot River Basin as summarized in Table E-IV. (See Plates No. E-28 thru E-32 for rating tables). The Keene Telemark is a non-recording gage which gives river stages only.

TABLE E-IV

DISCHARGE RECORDS

Location	Drainage Area	Period of Record
Ashuelot River at Hinsdale, N.H.	420	March 1907 -
South Branch Ashuelot River at Webb, N. H.	36.0	Oct 1920 -
Otter Brook below Dam,near Keene, N.H.	47.2	May 1958 -
*Otter Brook near Keene, N.H.	42.3	Oct 1923-Sept.1957
Ashuelot River below Surry Mt. Dam, nr. Keene, N. H.	101	September 1945 -
Ashuelot River at Gilsum, N.H.	71.1	August 1922 -

* Gaging station relocated downstream of Otter Brook Dam.

DESCRIPTION OF FLOODS

24. Flood History. - Outstanding floods on the Ashuelot River may result from early spring storms combined with melting snow such as the flood of March 1936 or from summer or fall storms such as the record flood of September 1938 (Table E-V). The recent flood of October 1959 produced substantial runoff, particularly on Otter Brook but the reservoirs modified the flood flow at Keene.

TABLE E-V

FLOODS OF RECORD

USGS Gaging Stations

Ashuelot River Nr. Gilsum, N. H. (1922 - present)

Date	Peak Discharge
Sept. 21, 1938	5220 c.f.s.
Mar. 18, 1936	4400 c.f.s.
Nov. 26, 1950	3700 c.f.s.
Apr. 12, 1934	3490 c.f.s.
Apr. 5, 1960	2800 c.f.s.
Nov. 4, 1927	2760 c.f.s.
Oct. 24, 1959	2700 c.f.s.

Otter Brook Nr. Keene, N. H. (1923 - 1958)

Date	Peak Discharge
Sept. 21,1938	6130 c.f.s.
*Oct. 24-25,1959	5000 c.f.s.
Mar. 18, 1936	3580 c.f.s.
Nov. 26, 1950	3540 c.f.s.
Nov. 4, 1927	3180 c.f.s.
Apr. 12, 1934	3020 c.f.s.
*Apr. 5, 1960	2000 c.f.s.

* Estimated flow at gaging station.

25. September 1938 Flood. - The greatest flood of record in the Ashuelot River Basin occurred on 21 September 1938 when a hurricane passed up the Connecticut River valley. Rainfall over the watershed accompanying this hurricane combined with the precipitation of the previous 3 days totaled more than 10 inches. The computed inflow to the Keene flood plain reached a peak of 31,200 c.f.s. with a maximum stage of 480.6 at the Telemark. (All elevations at the Telemark refer to Keene datum which is 5.3 feet above m.s.l.).

26. March 1936 Flood. - The second largest flood of record on the Ashuelot River was the flood of March 1936 which developed from heavy rains falling on snow cover with a high water content. The stage at the Telemark gage rose to 478.7 with a computed peak inflow of 23,000 c.f.s. to the Keene flood plain.

27. Standard Project Flood. - A standard project flood for Keene, New Hampshire, was developed as a demonstration flood to measure the effectiveness of Otter Brook and Surry Mountain Reservoirs. Since

the flood was to be used for demonstration rather than design purposes, it was determined by an approximate method. A rainfall value of 11.3 inches, which approximates 60 per cent of the maximum possible rainfall for 312 square miles, was selected for the Standard Project Storm. Rather than develop unit hydrographs for the component areas, the hydrographs of the September 1938 flood were selected as typical and were adjusted to equal the selected storm runoff. The Standard Project Flood for Keene, representing the total of the composite inflows to the Keene flood plain, has a maximum discharge of 42,000 c.f.s., which is 35 per cent greater than the flood of September 1938, the flood of record.

DISCUSSION OF THE KEENE FLOOD PLAIN

28. General. - As previously mentioned, the Ashuelot River and the two main tributaries converge in the flood plain just below Keene. Table E-VI gives the approximate drainage areas that contribute flows into the flood plain.

TABLE E-VI

DRAINAGE AREAS

LOCATION	DRAINAGE AREA IN SQUARE MILES	
Ashuelot River at The Branch	114	
The Branch at the Ashuelot River	100	
Otter Brook at The Branch		55
Minnewawa Brook at The Branch		33
Beaver Brook at The Branch		10
South Branch at the Ashuelot River	72	
Ash Swamp Brook at the Ashuelot River	18	
Local - Keene to West Swanzey	8	
Total at West Swanzey	312	

29. The meandering river channel in the flood plain has low discharge capacity due to its small cross sectional area and flat gradients, with the result that flood waters cause considerable depth of pondage in the plain.

30. A non-recording Telemark gage, near the Keene Sewage Pumping Station, is the principal index point for the flood plain. Stages at the Telemark are caused by a changing series of river flow conditions. Under normal river flows, stages are low and are related to the discharge in the Ashuelot River just below the

confluence with The Branch. As the flow in the Ashuelot River increases, the storage reach begins to fill. The Telemark stages are now caused by a combination of backwater and the flow in the Ashuelot River below the confluence with The Branch. As the flood plain continues to fill during a major flood, the Telemark stages become more and more dependent upon the backwater effect that is caused by the discharges at West Swanzey. As the river flows return to normal, the discharges below the confluence again control the fluctuations of the Telemark stages.

31. Channel Capacities. - Information obtained from observation during past floods indicate that the elevations or stages indicative of channel capacities downstream from the dams are as follows:

a. Winchester Street. - Stage = 6.5 feet, river well within banks but seepage starts to affect cellars. See Plate No. E-34 for relationship between Surry Mt. discharges and stages at the Telemark and Winchester Street.

Stage = 7.0, river still within banks, water table is raised, seepage affects more cellars. This should be the normal maximum stage.

Stage = 7.5 feet, river still within banks, seepage continued as the water table is even higher. This is the highest stage that should be reached and used only when heavy snow cover exists in the drainage area above Surry Mt. Dam.

b. Keene Telemark. - An elevation of about 472.5 at the Telemark gage near the Keene Sewage Pumping Station. Nuisance damage commences at this elevation with material damage starting at about 474.

c. Homestead Woolen Co. Dam (Dickinson). - Flood stage - 3.5 feet on the gage of the dam in West Swanzey (see Plate No. E-33 for rating curve).

d. Winchester, N. H. Gage. - Flood stage - 15 feet at the staff gage located just downstream of the highway bridge in Winchester.

e. Montague City, Mass. - Flood stage - 28 feet at the Montague City USGS gage on the Connecticut River.

PRECIPITATION AND RIVER REPORTING NETWORK

32. General. - Due to the short time of runoff concentration in the Ashuelot and its tributaries, the emphasis in the reporting network has been placed on the river stations instead of rainfall stations. Experience has shown that it is not expedient to compute the runoff in volume or peak by correlating the rainfall data. Plate No. E-4 shows the locations of the precipitation and stream gaging locations in and around the watershed.

33. Rainfall Reports. - Rainfall reports are used primarily for the purpose of alerting and for providing an appraisal on the severity of the storm. During severe storms the damtender maintains close contact with Reservoir Regulation Section to report rainfall and flood data and to receive regulation instructions. There are other precipitation stations in the watershed which are not part of the cooperative rainfall stations but their data is obtainable from the U. S. Weather Bureau in Hartford, (Windsor Locks), Connecticut.

34. River Reporting System. - The river reporting system in the Ashuelot River Watershed consists principally of the following stations in downstream order: (a) the staff gage on the Winchester Street Bridge in Keene, (b) the Telemark gage near the Keene Pumping Station, (c) the gage on the Homestead Woolen Co. Dam in West Swanzey, (d) the staff gage downstream of the highway bridge in Winchester, (e) Montague City on the Connecticut River. These observations are obtained either by the dam operators or by local observers. Complete information concerning other key locations on the Connecticut River and its tributaries are obtained from other operators of flood control dams, and the U.S.W.B. River Forecast Center at Windsor Locks, Connecticut.

35. Snow Surveys. - Snow courses have been established in or near the watersheds of both reservoirs to give an index of the water equivalent in the snow, which is used as a guide in the regulation of the reservoirs during the periods of snowmelt. The locations and other pertinent data on the snow courses are shown in Table E-VII. A summary of the water equivalent in the snow cover during the winter and spring months is shown in Table E-VIII.

TABLE E-VII

SNOW COURSES

Location	Elevation M.S.L.	Latitude	Longitude	Period of Record
Alstead	1400	43° - 08'	72° - 17'	Dec. 1948 -
Washington	1340	43° - 10'	72° - 05'	Dec. 1948-Apr. 1961
Sand Pond	1500	43° - 10'	72° - 11'	Jan. 1962 -
Marlow	1220	43° - 06'	72° - 12'	Dec. 1948 -
Surry	600	43° - 00'	72° - 19'	Dec. 1948 -
Granite Lake	1350	43° - 01'	72° - 09'	Jan. 1959 -
Otter Brook Dam	1050	42° - 57'	72° - 14'	Jan. 1959 -

TABLE E-VIII

WATER EQUIVALENT IN SNOW COVER
(Depth in Inches)

Date	Mean	Maximum	Minimum
1 February	2.7	5.4	0.9
15 February	3.4	7.6	0.8
1 March	4.1	8.4	0.6
15 March	4.9	9.4	1.0
1 April	3.6	8.8	0
15 April	1.4	6.5	0

36. Weather Forecasts. - Quantitative weather forecasts initiated by the U. S. Weather Bureau in Boston are received daily by the Reservoir Regulation Section. Whenever warranted, the dam operators are alerted with advisory weather bulletins.

ORGANIZATION AND COMMUNICATIONS

37. Organization. - In the New England Division, the Hydrology and Hydraulics Section in the Engineering Division serves a dual purpose since it also functions as the Reservoir Regulation Section. The Reservoir Regulation Section (RRS) is responsible for the regulation of the flood control reservoirs within the New England area. The supervision of routine operations and maintenance activities comes under the jurisdiction of the Maintenance Branch in the Operations Division. Instructions from RRS are issued directly to the dam operator with advisory reports forwarded to the Operations Division. An organization chart for reservoir regulation in the New England Division is shown on Plate No. E-1. In addition to its regular flood control duties, RRS is also responsible for (1) monthly reports on reservoir regulation, (2) continuing studies on regulation procedures, (3) analysis of actual flood operations, (4) the establishment and maintenance of a reporting network, and (5) the training of personnel.

38. Communications. - During normal working hours, communications between RRS and the dam operators is by the NED Radio Network. One radio "station" (WUA-1B) is located in the Reservoir Regulation Section. For emergency use there are numerous mobile sets available as well as 3 "transportable" units - one at NED headquarters, and two at strategic points in the New England area. If radio transmission is broken, communication is by telephone. During non-work hours, i.e., nights, holidays and week-ends, instructions to the dam operators are issued by telephone from the homes of RRS personnel unless the severity of the flood requires that the office be opened. Telephone numbers of all individuals concerned with reservoir regulation are listed on Plate No. E-2. In the event of a complete communication failure, arrangements have been made with the Chief of Police in Keene, N. H. for emergency use of the short-wave radio facilities of the State Police and Civil Defense.

RESERVOIR REGULATION FOR NORMAL PERIODS

39. Non-Freezing Season. -

a. Surry Mountain Reservoir. - A permanent recreation pool is maintained by the control weir(to be constructed in 1962)at a stage of about 15 feet. The normal setting for both conduit gates is 3 feet, and the weir gate will be closed. There is no change in the gate settings for fluctuations in pool stages up to 18 feet. The Reservoir Regulation Section is notified when the pool rises to a stage of 18 feet.

b. Otter Brook Reservoir. - A recreation pool is maintained by the control weir and stop logs at a stage of about 18 feet. Gates 1 and 3 are closed and gate 2 is open. The gates remain in this position until the pool reaches a stage of 21 feet, at which time the RRS shall be notified.

40. Freezing Season. -

a. The Reservoir Regulation Section will instruct the operators when the winter pools are to be established in the fall and drawn down in the spring.

b. Surry Mt. Reservoir. - The weir will be submerged with the pool stage maintained at about 17 feet to keep the gates free from ice. The weir gate will be fully opened in order to be used during the spring draw down. One conduit gate will be closed and the other gate will be partially open to maintain the winter pool. If the pool reaches a stage of 19 feet, the RRS shall be notified.

c. Otter Brook Reservoir. - The weir will be submerged with the pool stage maintained at about 20 feet. Gate 2 will be closed and gate 1 or 3 will also be closed. The other gate will be partially open to maintain the winter pool. If the pool reaches a stage of 24 feet, the RRS shall be notified.

41. Cooperation with Downstream Water Users. - It is the policy of the Corps of Engineers to cooperate, whenever possible, with downstream water users, police authorities, and other interested parties and agencies. The operator of the dam may be requested by downstream water users to modify the river flow for short periods of time. Whenever a request for such modification is received, the operator of the dam shall ascertain the validity of the request and obtain assurances from all other downstream water users that they are agreeable to the proposed operation. The operator of the dam will then relay the information to the Reservoir Regulation Section and request instructions.

RESERVOIR REGULATION DURING FLOODS

42. General. - The regulation of flows from both reservoirs may be considered in 3 phases during the course of the flood. Phase I is the initial regulation during the early development of the flood and ends following the first change in gate settings; Phase II, regulation during the flood when gates are either partially or completely closed; Phase III, regulation to empty the reservoirs following the recession of the flood.

43. Phase I - Initial Regulation of Flow. -

a. Partial closure of gates will be made; for minor or slowly rising floods not warranting complete closure of the gates, or during the initial development of a major flood prior to a full appraisal of its magnitude, as governed by any of the following conditions.

(1) To restrict the reservoir discharge in accordance with the curves shown on guide 'A', Plate No. E-34, that prescribes the total release from the reservoirs in which the discharge from Otter Brook is generally one half that from Surry Mt.

(2) To restrict the contribution from the reservoirs when the forecast stage at Montague City approaches flood stage of 28 feet.

b. Complete closure of gates in both reservoirs will be made at once for either of the following conditions, unless otherwise instructed by Reservoir Regulation Section.

(1) When a rainfall of 2 inches occurs within 24 hours at either dam or one of the cooperative rainfall stations.

(2) When elevations and rates of rise at the Telemark gage occur as follows: (See Plate No. E-34).

Elevation (In Feet)	Rate of Rise (In Feet Per Hour)
471	0.4 or more
470	0.6 or more
469	0.8 or more
468	1.0 or more

44. Phase II - Regulation During the Flood. - Although not always clearly defined, the transition from Phase I to Phase II takes place after the first gate operation, or, if there is no operation, after the river stage at the Telemark has crested and started to recede.

45. As a flood develops, considerable judgment and experience are necessary to vary the regulation in accordance with the amount of residual reservoir storages, river stages in Keene, water content of snow, if any, remaining on the watershed, and weather forecasts. In general, the continuation of regulation will be governed principally by the reservoir pool stages and the elevations at the Keene Telemark as shown by the series of guide curves on Plate No. E-34. Guide 'B' shows the relationships that exist between the Winchester Street stages and Surry Mt. releases, with different elevations at the Keene Telemark. Guide 'C' shows the allowable releases from the Surry Mt. reservoir with different pool stages during the growing and non-growing season. It reflects the relationships shown in 'B', along with the residual storage in Surry Mt., and the seasonal channel capacities. Guide 'D' shows the releases from Surry Mt. as a percentage of the total reservoir releases.

46. Secondary river rises from additional rainfall or snowmelt will be considered applicable to Phase II. With rising stages at the Telemark gage in Keene, consideration will be given to the travel times from the dams to Keene in order to anticipate river stages. A 4-hour travel time of flow from Surry Mt. Reservoir to the Telemark and a travel time of 1 to 2 hours from Otter Brook Reservoir have been found applicable.

47. The preceding conditions will usually govern the continuation of regulation in Phase II, but in some cases flood conditions on the Connecticut River will be the controlling factor. Regulation in Phase II will continue until the stage of the Connecticut River at Montague City has either receded 5 feet from flood crest, or to flood stage of 28 feet. The estimated travel time from West Swanzey to the mouth of the Ashuelot is from 12 to 15 hours. The travel time from the mouth of the Ashuelot to Montague City is about 7 hours.

48. Phase III - Emptying the Reservoir. - Following the recession of the flood on the Ashuelot River in Keene, or the Connecticut River at Montague City, the reservoirs will be emptied as rapidly as possible in accordance with the guide curves on Plate No. E-34. Except under unusual flood conditions, the releases from Surry Mt. Reservoir during the growing season shall not exceed a flow of 800 c.f.s., and during the rest of the year shall not exceed a flow of 1200 c.f.s. The releases from Otter Brook shall not exceed a flow of 600 c.f.s.

49. The rate of increase in reservoir discharge from Surry Mt. shall not exceed 200 c.f.s. per 2-hour period for discharges up to 600 c.f.s. and 100 c.f.s. per 2-hour period for discharges over 600 c.f.s. The rate of increase in reservoir discharge from Otter Brook shall not exceed 200 c.f.s. per 2-hour period. Increasing the discharges to produce stages causing material damage will be done only on instructions from the Reservoir Regulation Section. Plates No. E-22, E-23, E-25, E-26 show the outlet rating curves for the Surry Mt. and Otter Brook Reservoirs. Following the emptying of the reservoirs, the gates will be set at their normal openings.

50. Extraordinary Flood Conditions. - It is conceivable that unpredictable or extraordinary flood conditions may arise from dam or bridge failures, highway or railroad washouts, and ice jams or debris deposits. Regulation of the reservoirs during such unusual conditions may not follow the previously described rules, but will be governed by the urgency of the circumstances with the prime purpose of the operation to prevent further damage. The RRS will be immediately notified of any unusual flood condition.

51. Spillway Discharge. - Ordinarily during a major flood, the gates will not be opened to avoid spillway discharge. Surcharge storage above the spillway crest will be utilized if the downstream channel capacity continues to be exceeded by the runoff from uncontrolled areas. However, if the stage in either reservoir continues to rise above the crest with the possibility of the pool rising above the maximum design surcharge, the following schedule will be used as a guide for gate releases during spillway discharges:

Surry Mountain Dam		Otter Brook Dam	
Pool Stage	Gate Openings	Pool Stage	Gate Openings
65	0'- 0'	98	0'-0'-0'
|		|	
72	0'- 0'	109	0'-0'-0'
73	2'- 2'	110	2'-2'-2'
74	5'- 5'	111	3'-3'-3'
75	10'-10'(fully open)	112	4.5'-4.5'-4.5'(fully open)

The spillway rating curves are shown on Plates No. E-24 and E-27.

52. Effect of Regulation on Roads Within the Reservoir Areas. -

a. General. - There are several roads that pass through the reservoir areas and are subject to inundation during the storage of flood waters. Inasmuch as public safety is involved in the use of the roads, the dam operators are responsible for seeing that these roads are barricaded whenever necessary.

b. Surry Mt. - When a rising pool reaches a stage of 18 feet, the dam operator will consider barricading the access road to the recreation weir (lowest parking area stage about 20 feet). When a rising pool reaches a stage of 35 feet, the dam operator will consider barricading the old Surry Road north of Surry Village and will also notify local authorities about the possible need for closing old Pond Road.

c. Otter Brook. - The access road to the recreation area is barricaded during the fall, winter and spring months, and during the summer months on rainy days and every evening. In addition, when a rising pool reaches a stage of 27 feet, the dam operator will consider barricading the road (lowest parking area stage about 30 feet).

53. Regulation with Failure of Communications. - Should both the Surry Mt. and the Otter Brook operators be unable to contact the RRS when a flood is developing, the Surry Mt. operator has full authority to act promptly in accordance with the instructions contained herein, and will direct the regulation of both reservoirs until communications can be established.

54. The Surry Mt. operator will regulate the discharges from both reservoirs very conservatively during Phase I, especially if it is difficult to obtain necessary information on flood conditions. In the case of any doubt as to whether a partial gate or complete closure should be made, the gates will be closed completely whenever the severity of the storm and lack of information concerning downstream conditions warrant such action.

55. In the event that the Otter Brook operator is unable to contact either the RRS or the Surry Mt. operator by phone, he or his assistant will drive to Surry Mt. Dam to report on flood conditions. Should conditions be such that immediate reduction of the Otter Brook outflow is essential, the Otter Brook operator has full authority to make the necessary gate adjustments prior to reporting to Surry Mt. Releases for emptying the reservoirs will not be made until contact has been established with the RRS. Possession of the instructions contained in this manual does not relieve the dam operator of his responsibility for continued efforts to communicate with the RRS as prescribed in paragraph 38.

REPORTS

56. Normal Operations. - The normal operation of the reservoirs requires several weekly and monthly reports described as follows:

a. Weekly Communications Check. - On Friday morning of each week, a log report NED Form 477 (Plate No. E-37) on general hydrologic conditions at both reservoirs will be transmitted by radio from the Surry Mt. operator to RRS. The Otter Brook operator will relay his report to the Surry Mt. operator.

b. Reservoir Stages. - The automatic water level recorder records the water surface in each reservoir at all times and each recorder should be checked every morning to see that the chart is keeping correct time and that the pen is inking properly. Any discrepancies in the pen time or gage height should be noted on the chart. The chart at Surry Mt. should be changed once a week and at Otter Brook on the first of each month. At the beginning and ending of each chart the following information should be noted in ink:

(1) outside gage reading
(2) pen gage reading
(3) watch time
(4) pen time

c. Gate Operation Record. - All gate operations should be noted on NED Form 90 (Plate No. E-38) and inclosed with recorder charts of reservoir stages in the weekly and monthly reports. All operations should be noted regardless of the change in gate position. The report should include date and time of day, gate opening, reservoir stage, discharge before and after gate change, and reason for operation.

d. Tailwater Gage. - The dam operator will check the gage weekly during normal flows and daily during periods of flood flows. The checking of the gage is to make sure that the recorder is in good working order, noting any discrepancies between the inside and outside gage heights and time on the chart at the station and also on the chart of the remote recorder at Surry Mt. On the first of every week, the Surry Mt. dam operator will remove that portion of the chart on the remote recorder which contains the gage record. At the beginning and ending of each chart, the following information should be noted in ink: (1) name of gage, (2) date, (3) outside gage reading, (4) pen gage reading, (5) inside gage reading, (6) watch time, (7) pen time, and (8) clock time.

e. Rainfall Data. - The dam operator should read the rain gage daily and if less than 1/4" of precipitation has fallen, the pen of the recording gage should be raised to the next heavy line to prevent overlapping records. He also checks that the clock is running correctly and the pen is inking properly. Each Monday the chart will be changed and submitted with a weekly report to RRS. The weekly report is used principally to determine times of beginning and ending and form of precipitation. The monthly climatological report should be made out according to Weather Bureau instructions on each pad.

f. Snow Surveys. - Snow courses have been established at selected points within the watershed of each reservoir (see paragraph 35 and Plate No. E-4). Surveys will be made by the dam operators during the winter and early spring to determine the depth of the snow and its equivalent water content. The dates for the surveys will be determined each year by the Chief of the Reservoir Regulation Section.

57. Flood Control Operations. -

a. Log of Reports and Instructions. - During the regulation of the reservoirs for floods, information pertinent to the regulation will be entered in a log book (NED Form 423 - Plate No. E-39), or other prescribed forms for record purposes at the dams. A similar form will be maintained by the RRS. If unusual circumstances occur during a flood or upon request of the RRS, a report which may be written in longhand will be submitted to the

Division Office describing the subjects outlined in the following paragraphs.

b. Observations at the Dam. - The dam operator will make general observations of conditions occurring at the inlet and outlet works, as listed below. The observations will be entered in the log book at the dam. If possible, it is desirable to take photographs of any unusual conditions, noting the date, time and the reservoir gage height.

(1) Extent and action of eddies and waves along the spillway and intake channel walls.

(2) Extent and action of turbulence or eddies downstream of the spillway and outlet works.

(3) Effect on the flow through the gates due to an accumulation of ice or debris on the trash racks.

(4) The pool elevation and position of the gate opening at which vibration occurs.

(5) Any other hydraulic phenomena that may occur.

c. Observations at Damage Control Points. - General observations of real damage and nuisance damage will be made downstream of the dams. The report of observations will be used to establish and substantiate the range of damages in those areas to assist in the future operation of the reservoir. The information will be entered in the log book at the dam.

58. Conditions that Warrant an Initial Radio (or Telephone) Report. - The dam operator should report any of the following conditions promptly to the RRS:

a. Precipitation. - Occurrence of 1 inch of precipitation within 24 hours at either dam or any of the co-operative rainfall stations.

b. Telemark Stage. - A river elevation of 468 and rising at the Telemark gage near the Keene pumping station.

c. Reservoir Stages. -

1. Non-freezing season: A reservoir stage of 18 feet and rising at Surry Mt. and a reservoir stage of 21 feet and rising at Otter Brook.

2. Winter season: A reservoir stage of 19 feet and rising at Surry Mt. and a reservoir stage of 24 feet and rising at Otter Brook.

d. Any unusual local condition such as difficulty with gates, excessive debris, ice jams, etc.

59. Scope of Report. - Insofar as practicable, the following information should be included in a report to the Reservoir Regulation Section:

a. The total amount of precipitation at the dam.

b. Reports of precipitation received from other sources.

c. The pool elevation at the time of reporting and several previous readings with the corresponding time to define the hydrograph or rate of rise of the pool. Accurate, simultaneous readings of both stage and time are essential to facilitate computations of reservoir inflows (Plates No. E-35, E-36 and E-40).

d. Gate openings and discharges at the time of reporting.

e. River stages at the Telemark gage, Winchester Street gage, gage at Homestead Woolen Co. Dam in West Swanzey and, when instructed, at other pertinent locations, such as Swanzey Station Bridge, the Winchester, N. H. gage, the mouth of Minnewawa Brook, the mouth of the South Branch.

f. General snow cover and run-off conditions throughout the basin.

g. Any other information which might be of assistance in regulating the reservoirs.

60. Reports to the U. S. Weather Bureau. - The U. S. Weather Bureau at Bradley Field, Windsor Locks, Connecticut, has the responsibility for issuing flood warnings and forecasting river stages in the Connecticut River Basin, and it is essential for them to obtain from the flood control dams data on precipitation, river stages, and reservoir regulations.

61. Two types of reports will be made to the U.S.W.B.: (a) post card reports and (b) telephone reports. Post card reports are made daily on WB Form 612-24, which is furnished by the Weather

Bureau. Data to be shown on the post cards include precipitation, reservoir stages, and when applicable, temperature, snowfall and downstream river stages. The initial telephone report to the U. S. W. B. (Windsor Locks, National 3-3351, call collect) will be made by the Surry Mt. operator immediately after sending the initial alerting report to R.R.S. Data to be forwarded in this report include precipitation, reservoir stages, outflow, and river stages at index points with times of observations. The Weather Bureau office is open 24 hours a day, every day. Inasmuch as the R.R.S. is also in contact with the U.S.W.B., subsequent reports on flood conditions from the dam operator will be made in accordance with instructions from the Basin Regulator.

MISCELLANEOUS

62. Fish Life. - Whenever there is insufficient run-off from local areas during a regulation period, a minimum discharge of approximately 10 c.f.s. should be maintained for fish life.

63. Sedimentation. - Sedimentation surveys are made at both reservoirs during periods of low flow to determine the effects of sedimentation. Ranges have been established in both reservoir areas and are shown on Plates No. E-10 and E-13.

64. Absence from Dam. - The R.R.S. will be advised in advance whenever the operator of a dam will be absent overnight from his dam or his home.

EXAMPLES OF RESERVOIR REGULATION

65. General. - The following floods have been analyzed to show the applicability of the prescribed rules of regulation:

a. Flood of September 1938

b. Flood of March 1936

c. Standard Project Flood

d. April 1960 Flood

66. As the April 1960 flood occurred with both reservoirs in operation, this flood was taken as a demonstration flood and is described in considerable detail. Other floods are shown to give an

indication of the effect of the reservoirs on these floods at the reservoirs and at downstream index points. Considerable assumptions relative to stages and discharges in Keene were required to illustrate the regulations.

67. September 1938 Flood. - The regulation of both reservoirs for a recurrence of the record flood of September 1938, and the effect on downstream stations are shown on Plate No. E-41. There would have been no spillway discharge at either reservoir although both pool stages would have risen to within three feet of spillway crest.

68. March 1936 Flood. - Although the peak of this flood was less than the 1938 flood, the volume of runoff was greater, and spillway discharges would have occurred at both reservoirs. Plate No. E-42 shows the regulation of both reservoirs and the effect on downstream index points.

69. Standard Project Flood. - The effect of the two reservoirs on the standard project flood is shown on Plate No. E-43. Neither reservoir has sufficient capacity to contain the entire flood but the spillway discharges occur on the recession side of the downstream hydrographs and do not contribute to the maximum stage during the flood.

70. Spillway Design Flood. - Plates No. E-44 and E-45 show the effects of the reservoir regulations on the spillway design floods assuming each reservoir full to spillway crest at the beginning of the floods. Plate No. E-44 also shows the maximum pool elevations at Surry Mt. that occur with the gates open and closed during the flood.

71. April 1960 Flood. - To augment the data shown on Plate No. E-46, there is included below a narrative to further describe the reasons for some of the regulation procedures:

a.) 29 March 1960. - From snow survey reports the R.R.S. was aware that a heavy snow cover (water equivalent = 8.5 inches) existed on the Ashuelot River watershed and posed a potential flood threat.

b.) 31 March 1960

0800 - Initial report from Surry Mt. operator. It was raining, temperature was 41° at Surry Mt. Dam, and the Keene Telemark which reached 468 during the early A. M. hours had risen to 468.9. In the last 24 hours, 0.8" of rain had fallen at Surry Mt. and 0.85" at Otter Brook Dam. Instructed to call back at 1100.

1100. - 1.05" at Surry, 1.05" at Otter Brook, rain ended at 1030. Telemark had risen to 469.9. Instructed to call back at 1500.

1500 - Both pools were rising; Telemark at 470.7; although the Telemark was still rising, the rain had stopped. Because of heavy snow cover, it was considered necessary to increase discharge as much as possible from both reservoirs. Instructed to call the Basin Regulator at his home at 2100.

2100 - Both pools were still rising; Winchester Street at 5.7, Telemark at 471.6. Instructed to make no change in discharge and call back at 0815.

c) 1 April 1960

0815. - Both pools were still rising, Telemark at 472.2, Winchester Street at 6.75. Instructed to increase outflow from Surry and call back at 1530.

1530. - Winchester Street at 7.1, Telemark at 472.4, both reservoirs were still rising. Instructed to make no change in discharges and call back at 0815.

d) 2 April 1960

0815. - The Winchester Street stage rose to 7.35 during the night but had fallen to 7.1. The Telemark was 472.2. Because of variations in stage at Winchester Street, due to flows from the uncontrolled areas below the dam, it was considered that reservoir releases should not be increased until the stages leveled off. Instructed to call back at 1200.

1200. - Telemark at 472.2 and Winchester Street at 7.0 (and appeared to have leveled off). The discharge at Surry should be increased to try to make better use of the available capacity in the river. Up to now, there had been no reports of flooding from downstream residents. Instructed to increase Surry Mt. outflow and call Regulator at his home at 2100.

2100. - Surry Mt. operator called in to report the pools were both rising slowly, the Telemark had leveled off at 472.2, but the Winchester Street stage had risen to 7.3 feet. It was felt that because it was difficult to check the flood conditions from the uncontrolled areas at night, the releases from Surry Mt. should be decreased. Instructed to decrease outflow from Surry Mt. and call back at 0830.

e) 3 April 1960

0830. - Winchester Street at 7.0, Telemark had fallen to 472.2. Instructed to increase discharge from both reservoirs and call back at 1800.

1630. - As the weather forecast called for rainy weather during the night, the R.R.S. had been mobilized for 24-hour operation.

1800. - Pools were still rising, Telemark at 472.1, Winchester Street at 7.1 feet. The temperature was above freezing and it had just started to rain. Instructed to make no change in discharge and call R.R.S. at 2300.

2300. - Telemark at 472.2, Winchester Street had risen to 7.35, 0.40 inches of rain had fallen at both reservoirs. Instructed to decrease Surry Mt. outflow and call if Telemark reached 472.5.

f) 4 April 1960

0200. - Telemark had reached 472.5, rainfall totaled 0.85 inches at Surry Mt. Because of the time of day and the uncertain flow conditions from uncontrolled areas, instructed to shut both reservoirs completely and call back at 0800.

0800. - Rain had just stopped, total at Surry Mt. was 1.40 inches, total at Otter Brook was 1.35 inches, and total at Bradford (which is in the reporting network) was 1.41 inches. The Telemark peaked at 472.8 and had fallen slightly to 472.7. The Winchester Street stage peaked during the night at 7.5 feet and was at 7.2 feet. Instructed to start releases from Surry Mt. and call back at 1500.

1500. - River stages had fallen off a little, but to make sure that stages were leveling off, instructed to make no change in discharges and call back at 2100.

2100. - Telemark at 472.7, Winchester Street at 6.75. Weather forecast was for rainy weather. Instructed to call back if Telemark reached 473.3 or if Winchester Street rose to 7.5 feet.

g) 5 April 1960

0800. - Telemark at 473.3, Winchester Street at 7.45'. Rainfall started during the night with a total of

0.56 inches at Surry and 0.73 inches at Otter Brook. Instructed to decrease flow at Surry and call back at 1100.

1100. - Telemark at 473.5, Winchester Street at 7.50; 0.68 inches at Surry, 0.96 inches at Otter Brook. Instructed to close Surry completely and call back at 1530.

1530. - Reservoirs were still rising, Telemark at 473.6, Winchester Street at 7.5.

2200. - Temperature was still above freezing, rainfall had stopped with 0.98 inches at Surry and 1.13 inches at Otter Brook; Telemark at 473.5 and Winchester Street had fallen to 7.3. Instructed to start releasing from Surry Mt. and call back at 0700.

h) 6 April 1960

0700. - Telemark at 473.0 and Winchester Street at 6.85. As the river stages had fallen considerably, instructed to increase outflow from Surry Mt. and call back at 1100.

1100. - Stages continued to fall with Telemark at 472.7 and Winchester Street at 6.55. As it appeared that the flows from the uncontrolled areas above the flood plain were leveling off, the flows from both reservoirs could be increased. Instructed to stagger opening of gates of both reservoirs so that by 1300 Surry Mt. was at 2.0-2.0 and Otter Brook was at 1.0-1.0-1.0. Call at 1900.

1900. - Reservoir was still rising. Winchester Street at 7.1 feet, Telemark at 472.7. Instructed to increase outflow from Surry Mt. and call back at 0800.

i) 7 April 1960

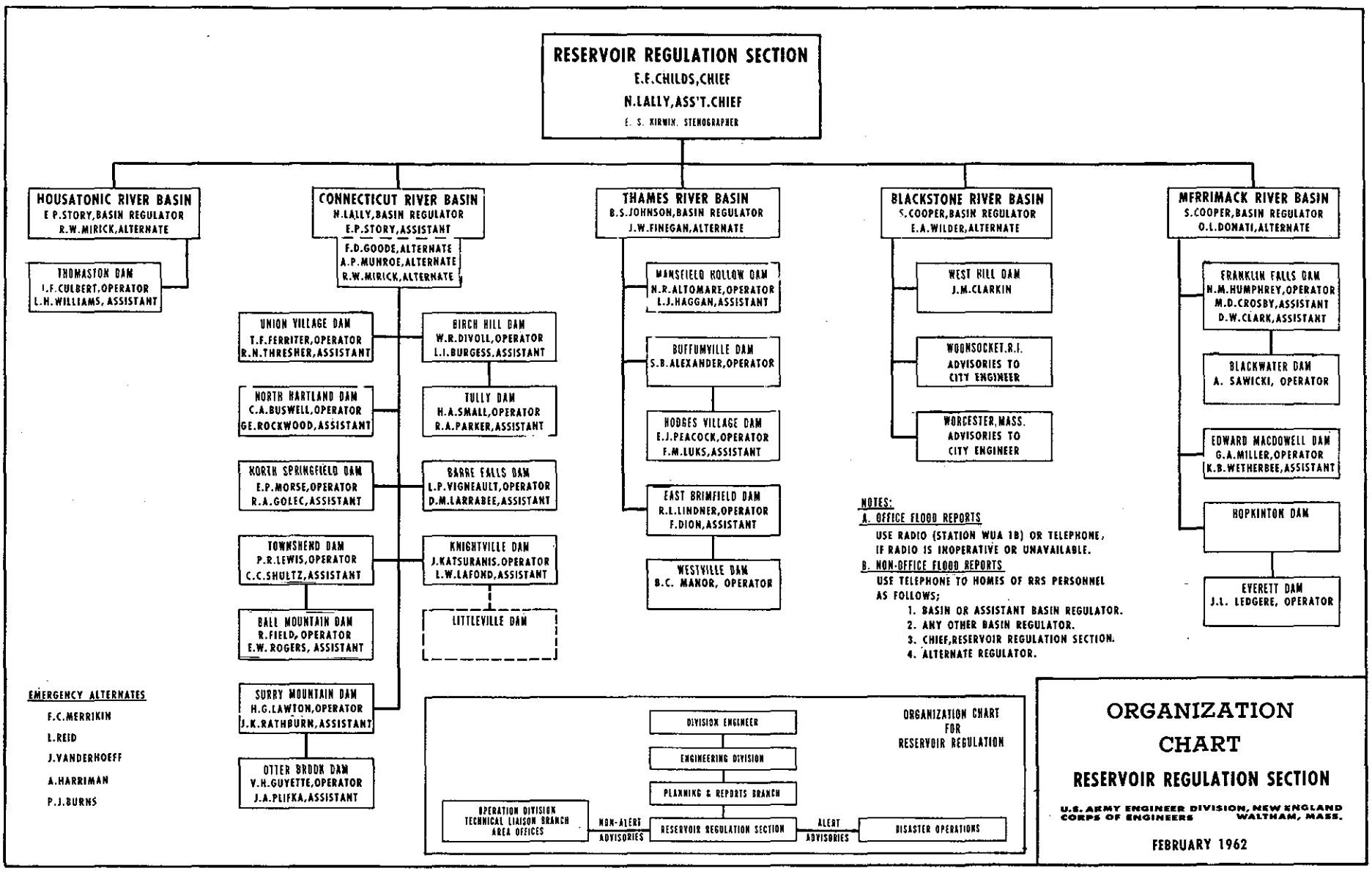
0800. - The discharge from the uncontrolled areas appeared to have fallen and became fairly steady as indicated by the Telemark stage of 472.3 and Winchester Street reading of 7.15.

1600. During the day as it became apparent that the stages at the index points were more and more dependent on the reservoir releases instead of flows from the uncontrolled areas, the releases from the reservoirs were increased so that at 1600 the discharge from Surry was 1130 c.f.s. and from Otter Brook 400 c.f.s. The Telemark had a stage of 472.2 and at Winchester Street the stage was 7.1.

j) The regulation of both reservoirs for the rest of the month came under Phase III of the Regulation. See 'D' on Plate No. E-34. Example - 1200 on 11 April. Pool stage at Surry = 51 feet, pool stage at Otter Brook = 79 feet. From 'D', the Surry Mt. releases should be about 68% of the total releases. Release from Surry Mt. = 1120 c.f.s., from Otter Brook = 510 c.f.s. The discharges were kept at a maximum in order to empty the reservoirs as soon as possible. During this time, there was still considerable snow cover which melted and kept the pool stages from falling too rapidly.

k) For a short time on 11 April, Otter Brook Reservoir was shut down completely to help in the recovery operation of a drowning victim.

The regulations ended on 6 May 1960.

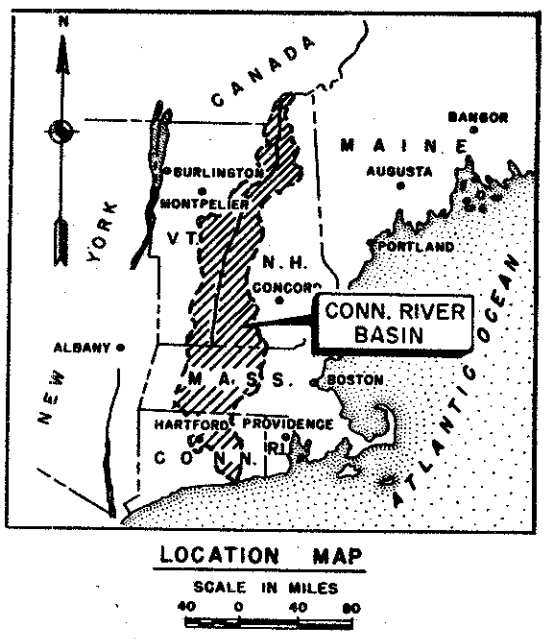

RESERVOIR REGULATION SECTION
E.F.CHILDS,CHIEF
N.LALLY,ASS'T.CHIEF
E. S. KIRWIN, STENOGRAPHER
HOUSATONIC RIVER BASIN
E P.STORY,BASIN REGULATOR
R.W.MIRICK,ALTERNATE
THOMASTON DAM
I.F.CULBERT,OPERATOR
L.H.WILLIAMS, ASSISTANT
CONNECTICUT RIVER BASIN
N.LALLY,BASIN REGULATOR
E.P.STORY,ASSISTANT
F.D.GOODE,ALTERNATE
A.P.MUNROE,ALTERNATE
R.W.MIRICK,ALTERNATE
UNION VILLAGE DAM
T.F.FERRITER,OPERATOR
R.N.THRESHER,ASSISTANT
BIRCH HILL DAM
W.R.DIVOLL,OPERATOR
L.I.BURGESS,ASSISTANT
NORTH HARTLAND DAM
C.A.BUSWELL,OPERATOR
GE.ROCKWOOD,ASSISTANT
TULLY DAM
H.A.SMALL,OPERATOR
R.A.PARKER,ASSISTANT
NORTH SPRINGFIELD DAM
E.P.MORSE,OPERATOR
R.A.GOLEC,ASSISTANT
BARRE FALLS DAM
L.P.VIGNEAULT,OPERATOR
D.M.LARRABEE,ASSISTANT
TOWNSHEND DAM
P.R.LEWIS,OPERATOR
C.C.SHULTZ,ASSISTANT
KNIGHTVILLE DAM
J.KATSURANIS,OPERATOR
L.W.LAFOND,ASSISTANT
BALL MOUNTAIN DAM
R.FIELD, OPERATOR
E.W. ROGERS, ASSISTANT
LITTLEVILLE DAM
SURRY MOUNTAIN DAM
H.G.LAWTON,OPERATOR
J.K.RATHBURN,ASSISTANT
OTTER BROOK DAM
V.H.GUYETTE,OPERATOR
J.A.PLIFKA,ASSISTANT
THAMES RIVER BASIN
B.S.JOHNSON,BASIN REGULATOR
J.W.FINEGAN,ALTERNATE
MANSFIELD HOLLOW DAM
N.R.ALTOMARE,OPERATOR
L.J.HAGGAN,ASSISTANT
BUFFUMVILLE DAM
S.B.ALEXANDER,OPERATOR
HODGES VILLAGE DAM
E.J.PEACOCK,OPERATOR
F.M.LUKS,ASSISTANT
EAST BRIMFIELD DAM
R.L.LINDNER,OPERATOR
F.DION,ASSISTANT
WESTVILLE DAM
B.C. MANOR, OPERATOR
BLACKSTONE RIVER BASIN
S.COOPER,BASIN REGULATOR
E.A.WILDER,ALTERNATE
WEST HILL DAM
J.M.CLARKIN
WOONSOCKET,R.I.
ADVISORIES TO
CITY ENGINEER
WORCESTER,MASS.
ADVISORIES TO
CITY ENGINEER
MERRIMACK RIVER BASIN
S.COOPER,BASIN REGULATOR
O.L.DONATI,ALTERNATE
FRANKLIN FALLS DAM
N.M.HUMPHREY,OPERATOR
M.D.CROSBY,ASSISTANT
D.W.CLARK,ASSISTANT
BLACKWATER DAM
A. SAWICKI, OPERATOR
EDWARD MACDOWELL DAM
G.A.MILLER,OPERATOR
K.B.WETHERBEE,ASSISTANT
HOPKINTON DAM
EVERETT DAM
J.L. LEDGERE, OPERATOR
NOTES:
A. OFFICE FLOOD REPORTS
USE RADIO (STATION WUA 18) OR TELEPHONE,
IF RADIO IS INOPERATIVE OR UNAVAILABLE.
B. NON-OFFICE FLOOD REPORTS
USE TELEPHONE TO HOMES OF RRS PERSONNEL
AS FOLLOWS;
1. BASIN OR ASSISTANT BASIN REGULATOR.
2. ANY OTHER BASIN REGULATOR.
3. CHIEF,RESERVOIR REGULATION SECTION.
4. ALTERNATE REGULATOR.
EMERGENCY ALTERNATES
F.C.MERRIKIN
L.REID
J.VANDERHOEFF
A.HARRIMAN
P.J.BURNS
DIVISION ENGINEER
ENGINEERING DIVISION
PLANNING & REPORTS BRANCH
OPERATION DIVISION
TECHNICAL LIAISON BRANCH
AREA OFFICES
NON-ALERT
ADVISORIES
RESERVOIR REGULATION SECTION
ALERT
ADVISORIES
DISASTER OPERATIONS
ORGANIZATION CHART
FOR
RESERVOIR REGULATION
ORGANIZATION
CHART
RESERVOIR REGULATION SECTION
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
FEBRUARY 1962

TELEPHONE DIRECTORY

February 1962

1.	Dam Personnel		
	a. Surry Mt. Dam		
	Harry G. Lawton	Keene, N. H.	Elmwood 2-2447
	John K. Rathburn	Hancock, N. H.	LA 5-3745
	b. Otter Brook Dam		
	Vernon H. Guyette	Keene, N. H.	Elmwood 2-4130
	James A. Plifka	" "	Emerson 3-4489
2.	Rainfall Observers		
	Mrs. Ruth F. Moore	Bradford, N. H.	
3.	River Observers(Ashuelot River)		
	a. Old Faulkner & Colony Mill	Keene, N. H.	Elmwood 2-2443
	b. Sewage Pumping Station	" "	" 2-1713
	Mr. Eric Whalen (Home)	" "	" 2-0200
	Telemark	" "	" 2-4046
	c. Homestead Woolen Co.	" "	" 2-2022
	West Swanzey, N. H.		
	d. A.C.Lawrence Leather Co.	Winchester, N. H.	Cedar 9-4321
	Mr. F.E. Store(Home)	Keene, N. H.	Elmwood 2-0477
	e. New England Box Co.	Winchester, N. H.	Cedar 9-4201
	Mr. R. H. Foster (Home)	Keene, N. H.	Elmwood 2-4321
	f. Mike Aivaleatis	Winchester, N. H.	Cedar 9-8883
	Winchester Restaurant	(near staff gage)	
	g. Winchester Paper Co.	Ashuelot, N. H.	Cedar 9-6632
	Mr. J. R. Ellis (Home)	Hinsdale, N. H.	Edgewater 6-5633
	Mr. R. Delano (Home)	" "	" 6-5392
	h. Paper Service Mills, Inc.	Ashuelot, N. H.	" 6-5311
	Mr. R. H. O'Neal, Pres.	Hinsdale, N. H.	" 6-5475
	i. Ashuelot Paper Co.	" "	" 6-5432
	Mr. H. Amidon (Home)	" "	" 6-5643
	Mr. E. McCormick (Home)	" "	" 6-5337
	Mr. R. M. Garfield (Home)	" "	" 6-5616
	j. G. E. Robertson & Co.	" "	" 6-5551
	Mr. F. Major (Home)	" "	" 6-5606
	Mr. L Gratton (Home)	" "	" 6-5603
	k. Gratton-Weeks, Inc.	" "	" 6-5551
4.	Local Authorities		
	a. Chief Selectman (Surry)	Walpole, N. H.	Skyline 6-3609
	b. Supt. of Public Works	Keene, N. H.	Elmwood 2-6550
	Mr. J. F. Burke (Home)	" "	" 2-0822
	c. City Engineer	" "	" 2-6550
	Mr. R. Shaw (Home)	" "	" 2-3972
	d. City Manager	" "	" 2-5211
	Mr. D. Chick (Home)	" "	" 2-0397
	e. Chief of Police	" "	" 2-3023
	Mr. W. Bridgham (Home)	" "	" 2-4563
	f. New Hampshire State Police	Concord, N. H.	Capitol 5-5571

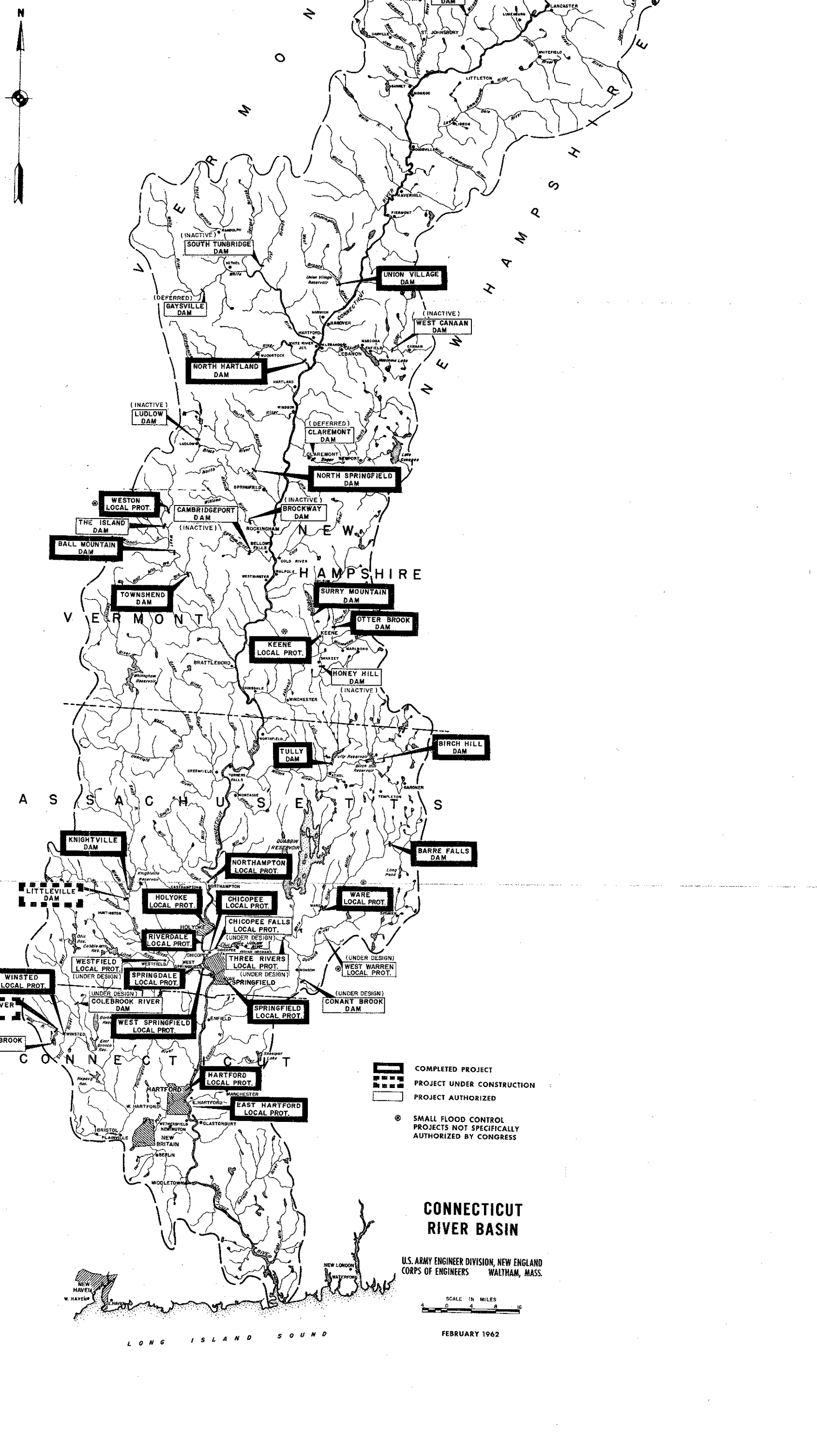
PLATE NO. E-2



LOCATION MAP

SCALE IN MILES

40 0 40 80



COMPLETED PROJECT

PROJECT UNDER CONSTRUCTION

PROJECT AUTHORIZED

⊛ SMALL FLOOD CONTROL PROJECTS NOT SPECIFICALLY AUTHORIZED BY CONGRESS

CONNECTICUT RIVER BASIN

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.

SCALE IN MILES

4 0 4 8 16

FEBRUARY 1962

PLATE NO. E-3

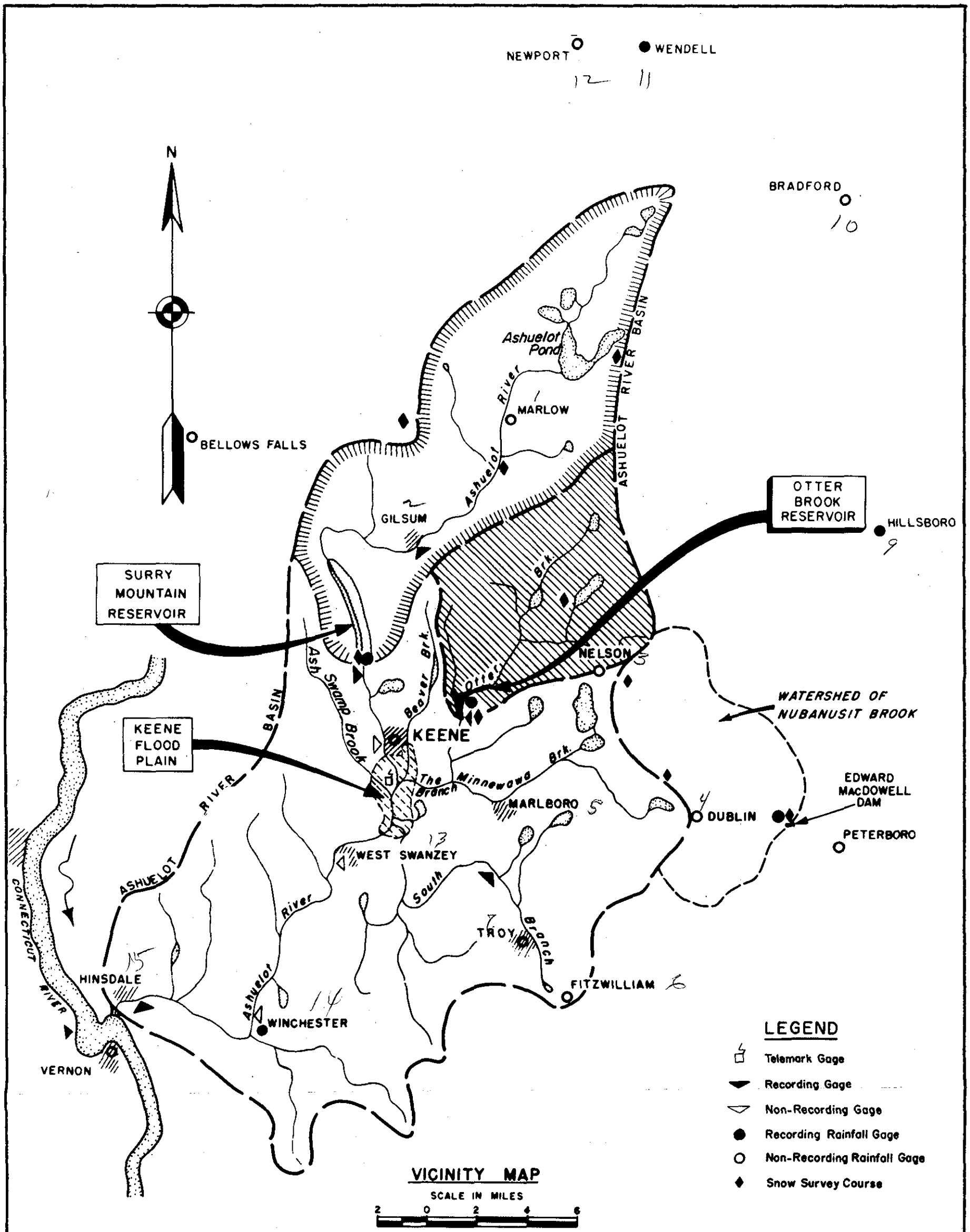


PLATE NO. E-4

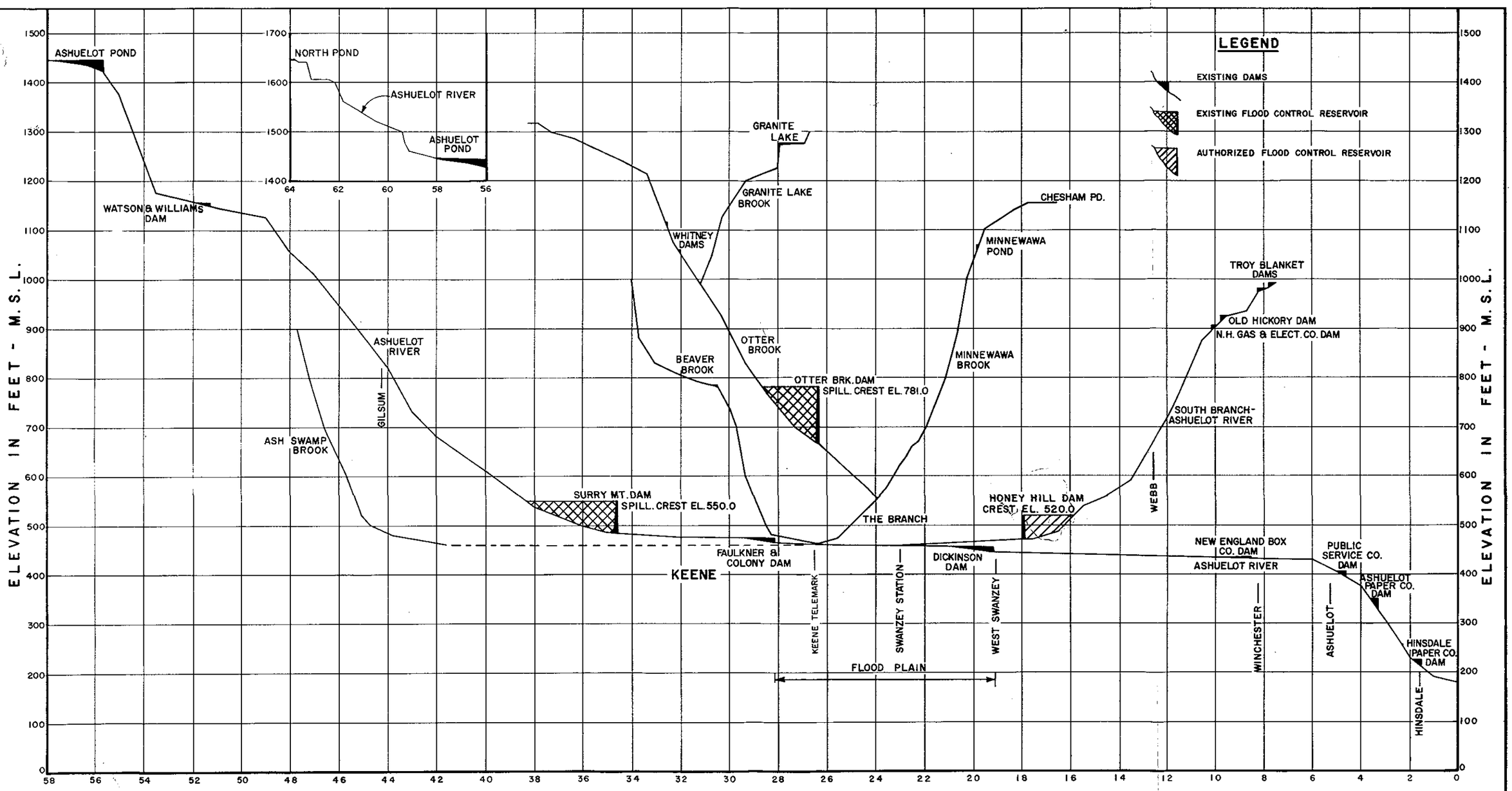
CONNECTICUT RIVER FLOOD CONTROL

ASHUELOT RIVER WATERSHED

PRECIPITATION & STREAM REPORTING NETWORK

NEW ENGLAND DIVISION WALTHAM, MASS.

FEBRUARY 1962



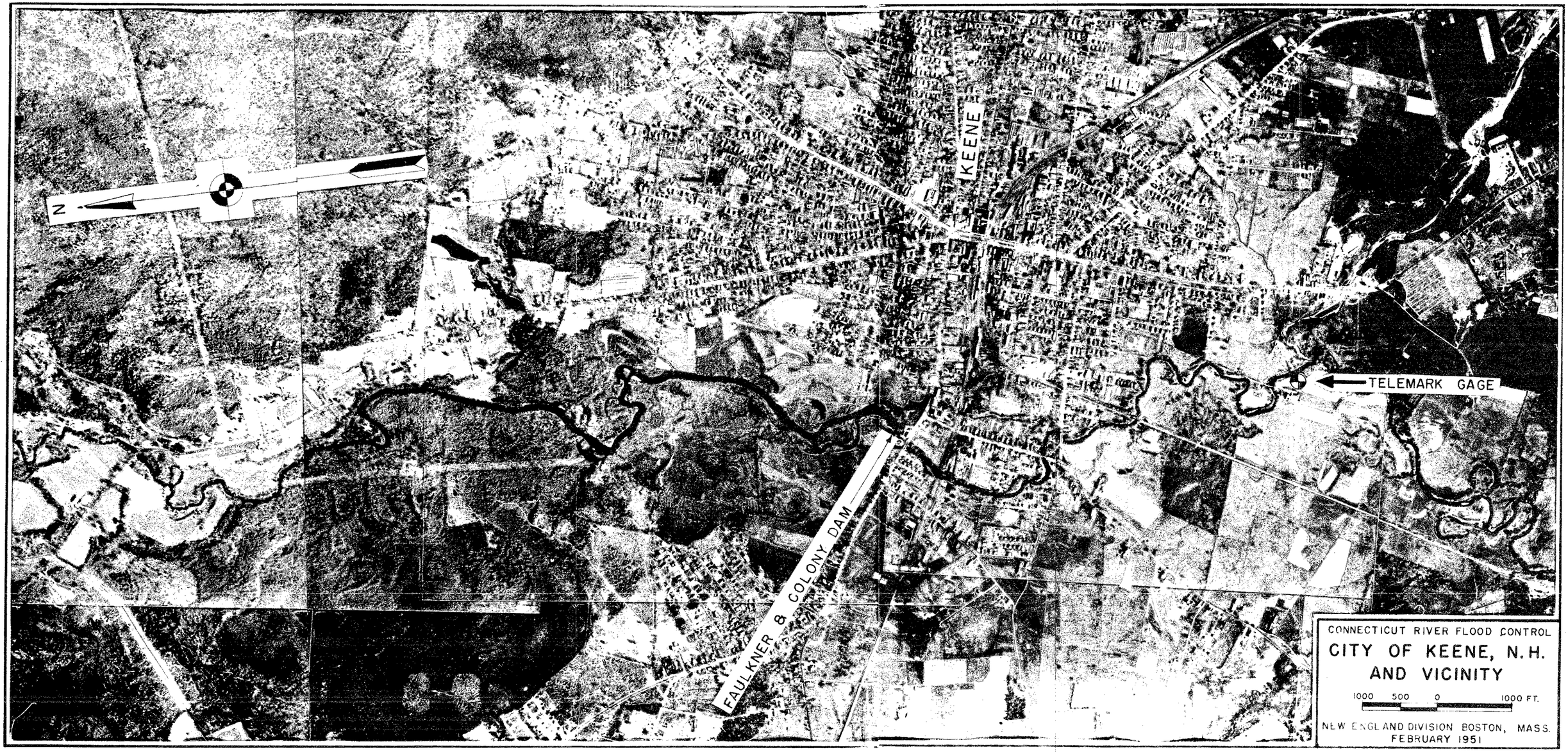
CONNECTICUT RIVER FLOOD CONTROL

ASHUELOT RIVER BASIN PROFILES

ASHUELOT RIVER AND TRIBUTARIES

NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRUARY 1962

PLATE NO. E-5



CONNECTICUT RIVER FLOOD CONTROL

CITY OF KEENE, N.H. AND VICINITY

1000 500 0 1000 FT.

NEW ENGLAND DIVISION BOSTON, MASS.
FEBRUARY 1951

PLATE NO E-6

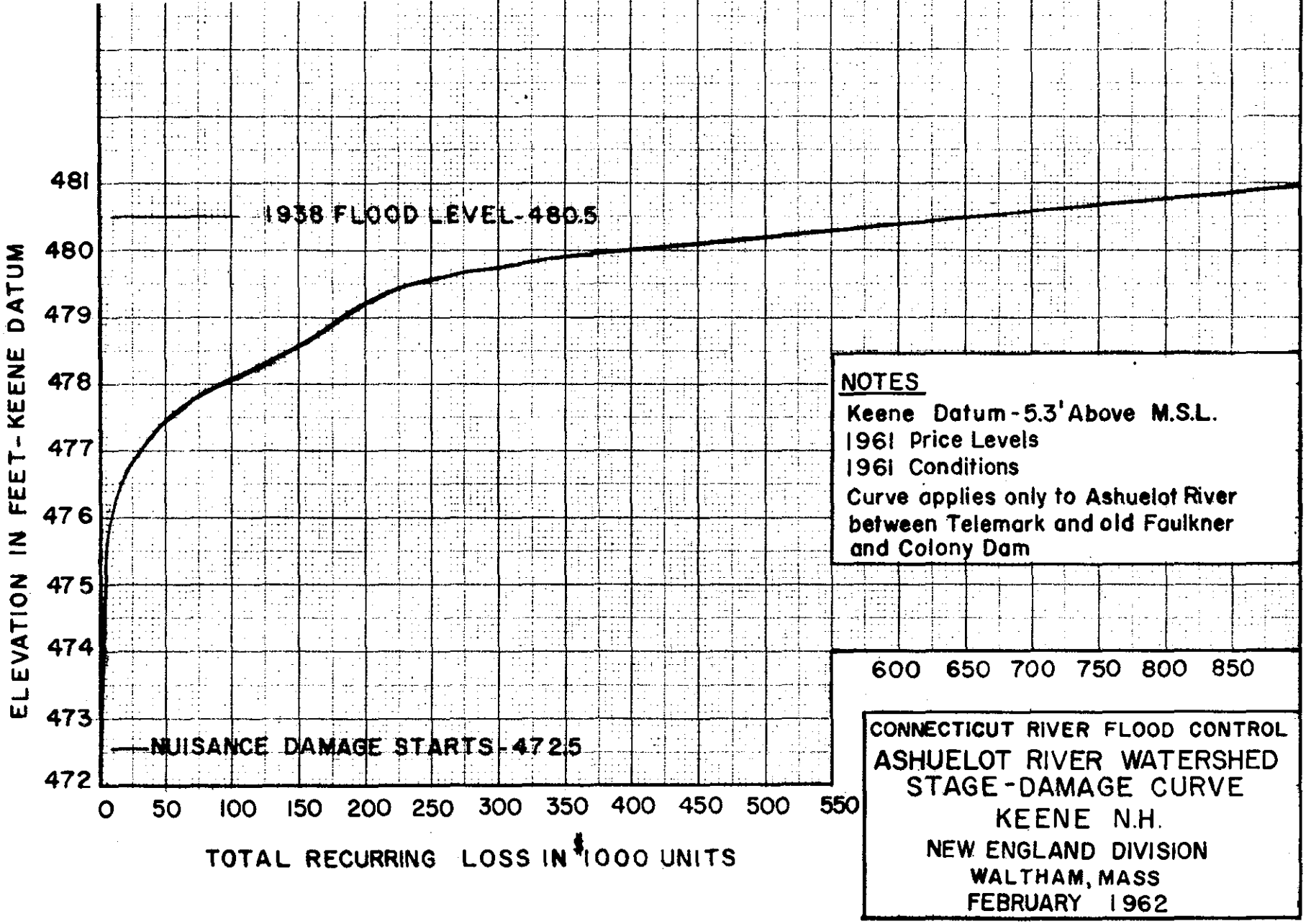

ELEVATION IN FEET-KEENE DATUM
481
480
479
478
477
476
475
474
473
472
1938 FLOOD LEVEL-480.5
NUISANCE DAMAGE STARTS-472.5
0 50 100 150 200 250 300 350 400 450 500 550
600 650 700 750 800 850
TOTAL RECURRING LOSS IN $1000 UNITS
NOTES
Keene Datum-5.3' Above M.S.L.
1961 Price Levels
1961 Conditions
Curve applies only to Ashuelot River between Telemark and old Faulkner and Colony Dam
CONNECTICUT RIVER FLOOD CONTROL
ASHUELOT RIVER WATERSHED
STAGE-DAMAGE CURVE
KEENE N.H.
NEW ENGLAND DIVISION
WALTHAM, MASS
FEBRUARY 1962

PLATE NO. E-7

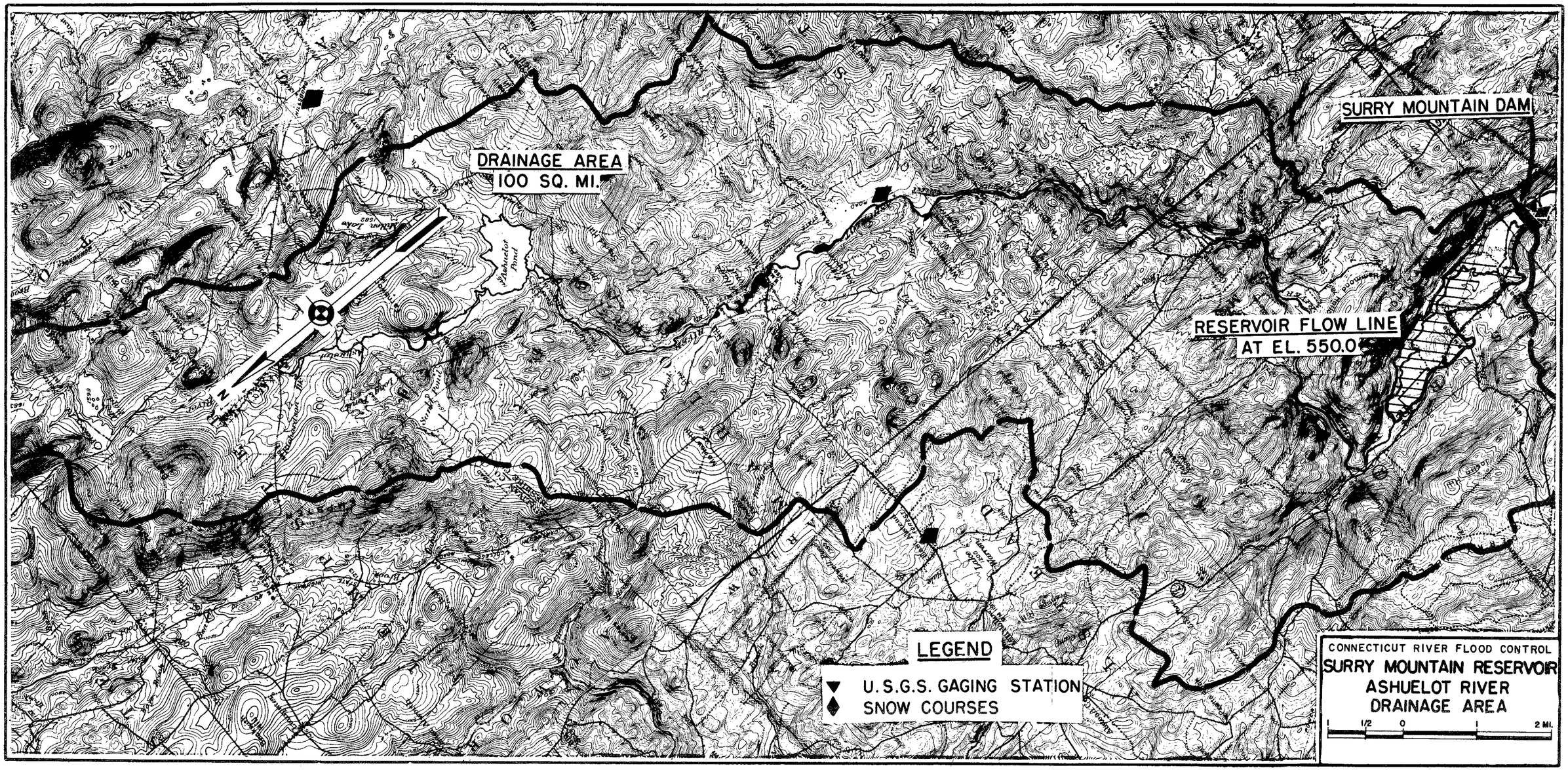
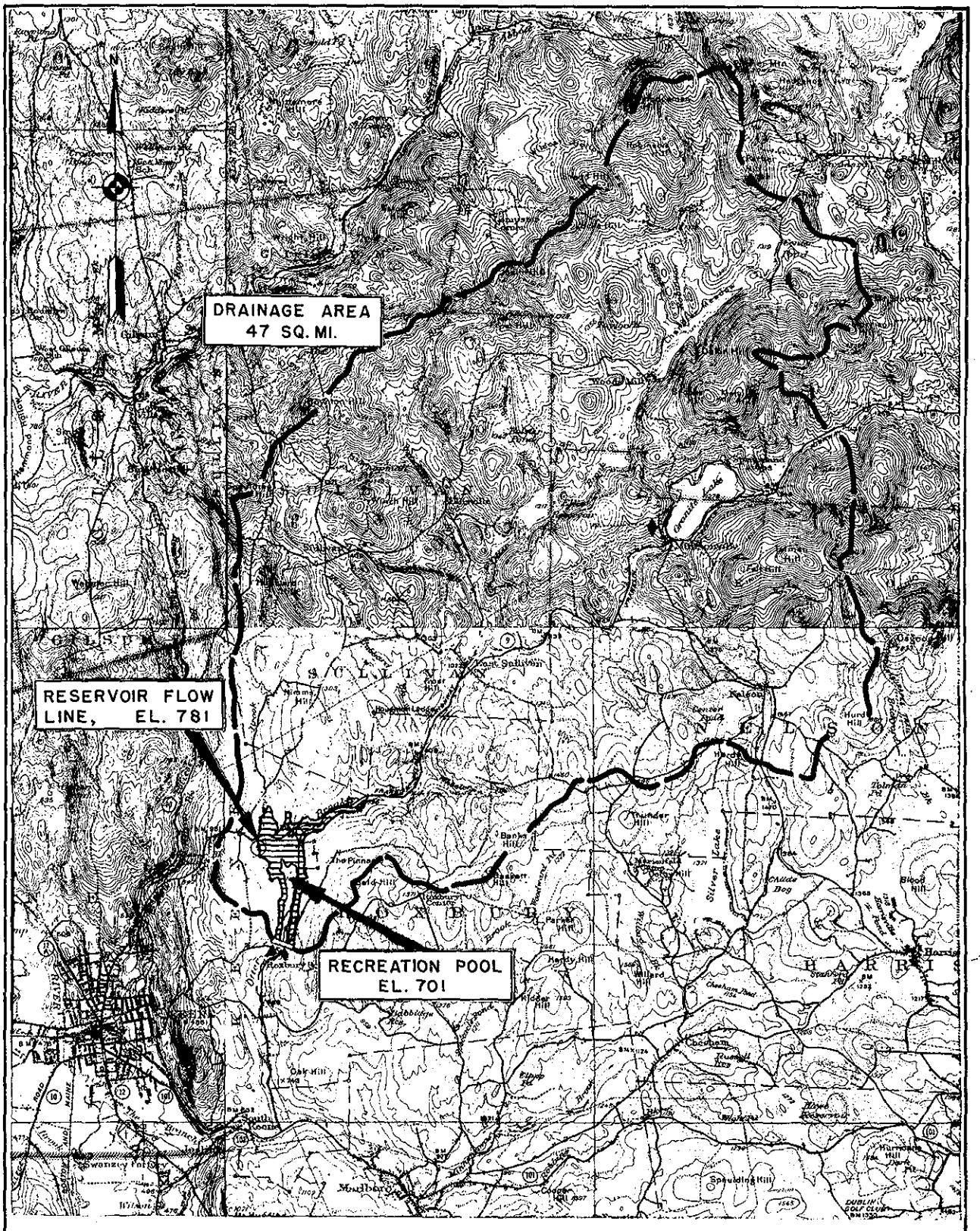

DRAINAGE AREA
100 SQ. MI.
SURRY MOUNTAIN DAM
RESERVOIR FLOW LINE
AT EL. 550.0
LEGEND
U.S.G.S. GAGING STATION
SNOW COURSES
CONNECTICUT RIVER FLOOD CONTROL
SURRY MOUNTAIN RESERVOIR
ASHUELOT RIVER
DRAINAGE AREA
1/2
0
2 MI.

PLATE NO.E-6



LEGEND

- U.S.G.S. Gage
- Snow Survey Course

CONNECTICUT RIVER FLOOD CONTROL
OTTER BROOK RESERVOIR
OTTER BROOK, N. H.

DRAINAGE AREA

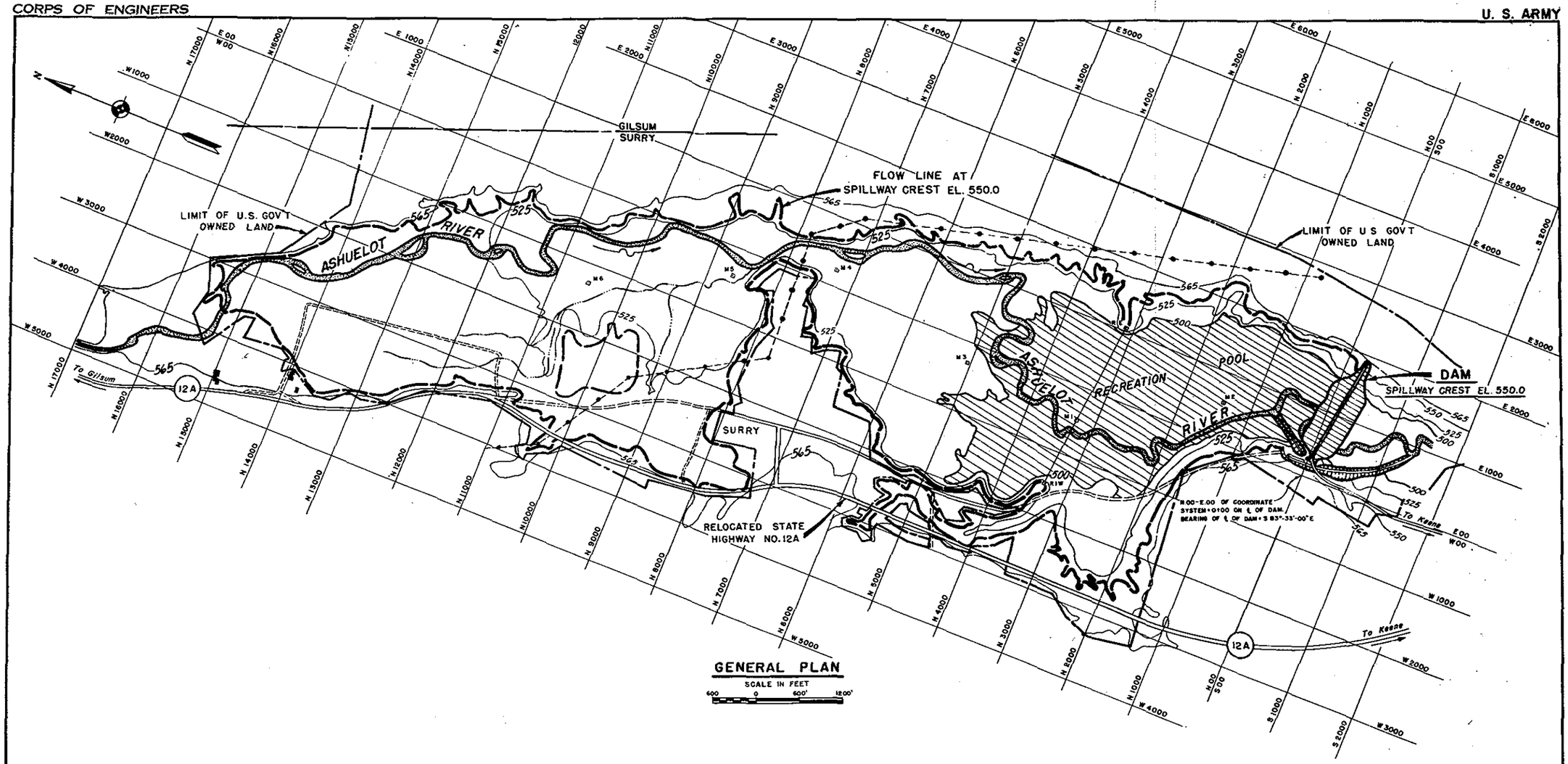
SCALE IN MILES

0 2

PLATE NO. E-9

CORPS OF ENGINEERS

U. S. ARMY



GENERAL PLAN

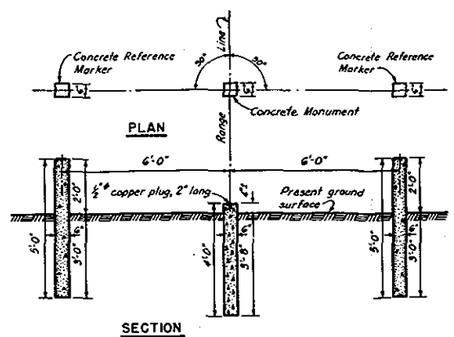
SCALE IN FEET

600 0 600' 1200'

RANGE MONUMENTS		
MONUMENT NO.	COORDINATES	TOP EL.
R1E	N 3119.89 E 1049.87	551.11
R1W	N 3379.17 W 1494.74	551.60
M1	N 3275.48 W 478.93	495.45
M2	N 1430.93 E 542.89	493.21
M3	N 5045.46 W 295.14	502.63
M4	N 7295.46 E 255.38	511.11
M5	N 6679.96 W 408.34	513.03
M6	N 10,576.96 W 1283.64	521.72

SEDIMENTATION RECORD										
DATE OF SURVEY	REDUCTION OF AREA AT RANGES - SQ FT				DEPTH OF SEDIMENT AT MARKERS - FEET						USABLE RESERVOIR CAPACITY AC. FT	REMARKS
	R1				M1	M2	M3	M4	M5	M6		
May 1950.	—				(495.0) 0.0	(492.86) 0.0	(501.86) 0.0	(510.55) 0.0	(512.31) 0.0	(521.27) 0.0	32,500	Initial Survey
Aug 1956					(495.20) +0.20	(493.04) +0.18 (1)	(502.00) +0.14	(510.67) +0.12	(512.06) -0.25	(521.22) -0.05		Monuments M3 & M6 read Nov. 1956

Note:
(1) Not true reading - topsoil excavated from area
(2) Elevations in (495.0) are ground surface beside monument



DETAILS OF RANGE MONUMENTS

SCALE 1" = 1'-0"

NOTES

Elevations refer to Mean Sea Level Datum.

Coordinates are based on dam centerline. See note on plan above.

For survey information, see Field Book No. FC-51.

For Range Profiles see Sheets Nos. CT-9-1198 & CT-9-1199.

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

DES. BY W.S. | DR. BY B.G. | CK. BY G.F.B.

CHIEF, DESIGN BRANCH

PROJECT ENGINEER

SUBMITTED BY:

CHIEF, PLANNING & REPORTS BR.

APPROVED:

CHIEF ENGINEERING DIV.

CONNECTICUT RIVER FLOOD CONTROL

SURRY MOUNTAIN RESERVOIR

RESERVOIR AND SEDIMENTATION MAP

ASHUELOT RIVER NEW HAMPSHIRE

APPROVED: DATE JUNE 1951

COL., C.E. DIVISION ENGINEER

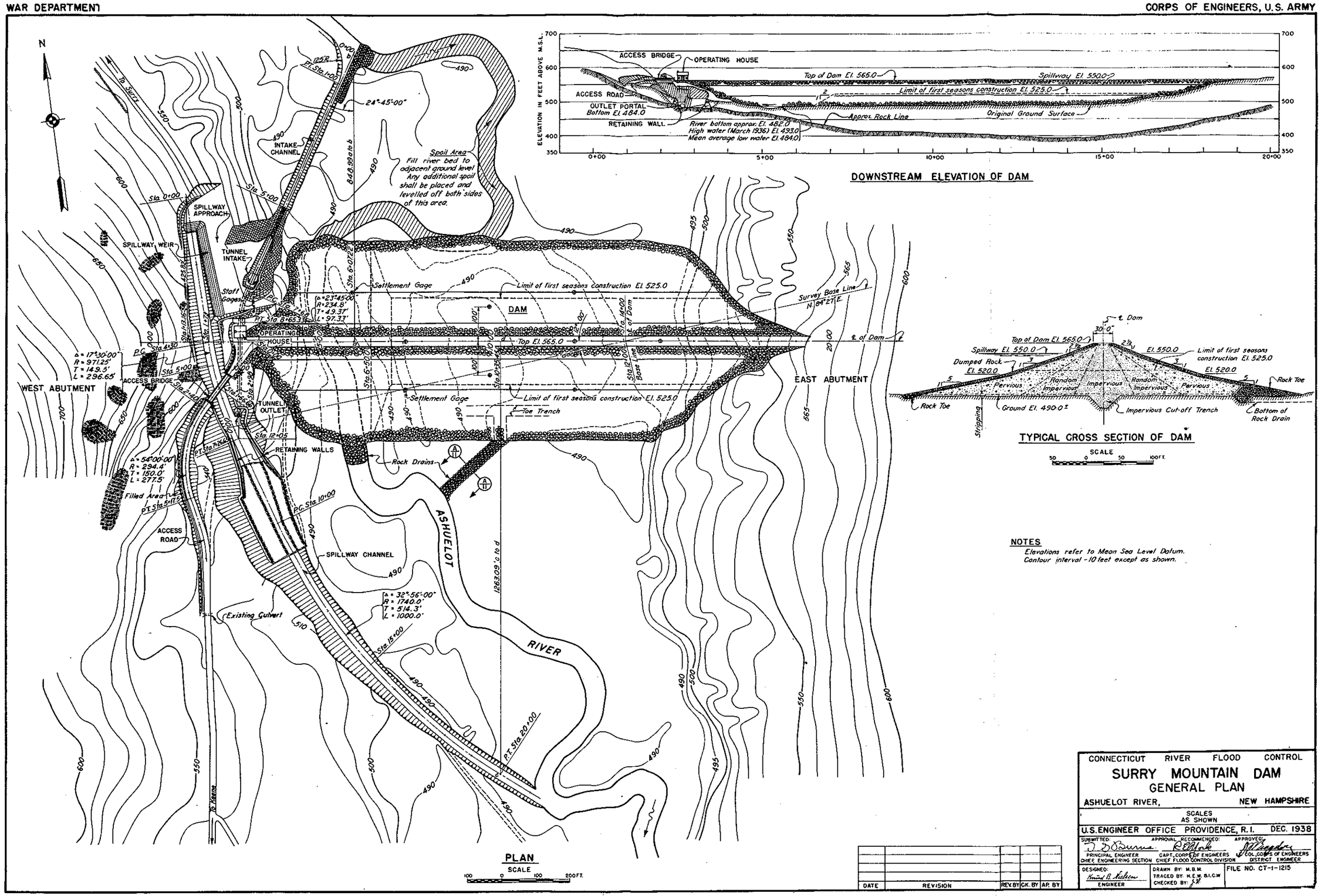
SCALE AS SHOWN | SPEC. NO.

DRAWING NUMBER
CT-9-1193

PLATE NO. E-10

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY



PLAN

SCALE 100 0 100 200 FT.

DOWNSTREAM ELEVATION OF DAM

TYPICAL CROSS SECTION OF DAM

SCALE 50 0 50 100 FT.

NOTES

Elevations refer to Mean Sea Level Datum.
Contour interval - 10 feet except as shown.

DATE	REVISION	REV. BY	CK. BY	AP. BY

CONNECTICUT RIVER FLOOD CONTROL

SURRY MOUNTAIN DAM
GENERAL PLAN

ASHUELOT RIVER, NEW HAMPSHIRE

SCALES AS SHOWN

U.S. ENGINEER OFFICE PROVIDENCE, R.I. DEC. 1938

SUBMITTED: D. D. Burns, PRINCIPAL ENGINEER, CHIEF ENGINEERING SECTION

APPROVAL RECOMMENDED: R. C. Hoyt, CAPT., CORPS OF ENGINEERS, CHIEF FLOOD CONTROL DIVISION

APPROVED: J. J. Kingsbury, COL., CORPS OF ENGINEERS, DISTRICT ENGINEER

DESIGNED: Kenneth A. Nelson, ENGINEER

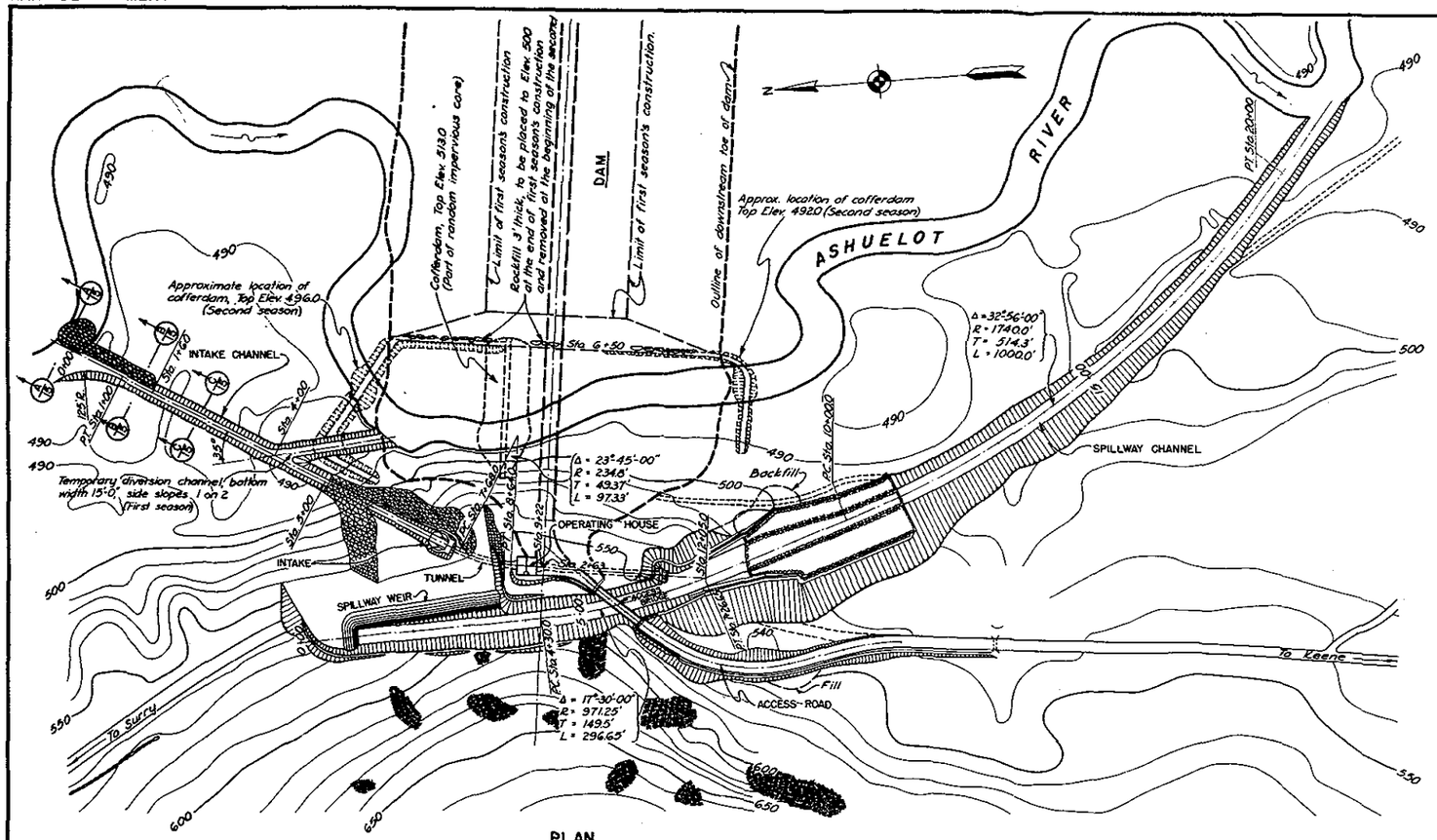
DRAWN BY: M.B.M.
TRACED BY: H.E.W. B.I.C.W
CHECKED BY: J.S.P.

FILE NO. CT-1-1215

PLATE NO. E-11

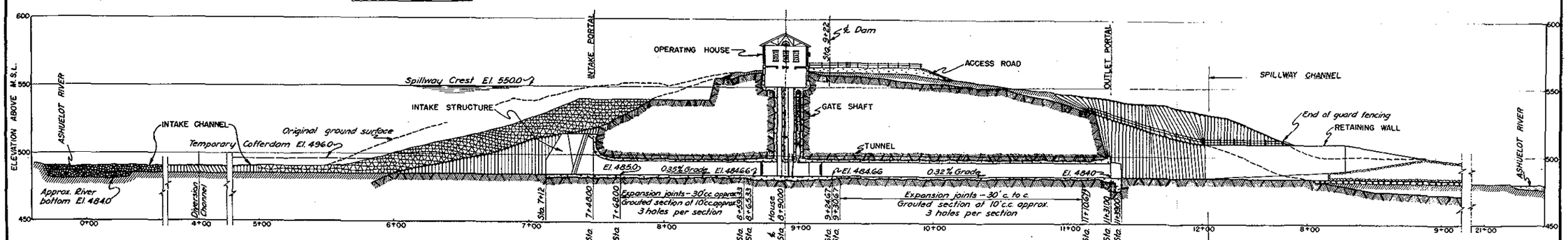
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY



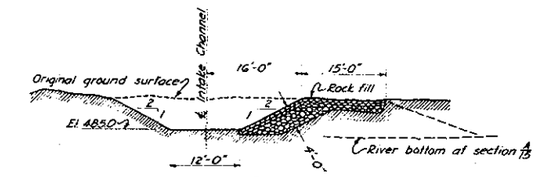
PLAN

SCALE 100 0 100 200 FT.



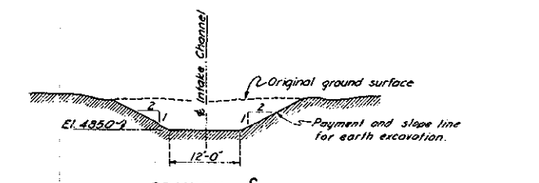
SECTION ON CENTER LINE OF TUNNEL

SCALE 25 0 50 FT.



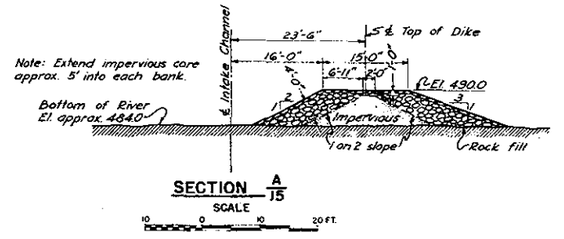
SECTION B/15

Scale: same as Section A/15



SECTION C/15

Scale: same as Section A/15



SECTION A/15

SCALE 10 0 10 20 FT.

NOTES

Elevations refer to Mean Sea Level Datum.

DATE	REVISION	REV. BY	CK. BY	AP. BY

CONNECTICUT RIVER FLOOD CONTROL

SURRY MOUNTAIN DAM
OUTLET WORKS

ASHUELOT RIVER, NEW HAMPSHIRE

SCALE AS SHOWN

U.S. ENGINEER OFFICE, PROVIDENCE, R.I. DEC. 1938

SUBMITTED:	APPROVAL RECOMMENDED:	APPROVED:
J. D. Burns, PRINCIPAL ENGINEER, CHIEF, ENGINEERING SECTION	C. C. Mark, CAPT., CORPS OF ENGINEERS, CHIEF, FLOOD CONTROL DIV.	W. Wragdon, LT. COL., CORPS OF ENGINEERS, DISTRICT ENGINEER

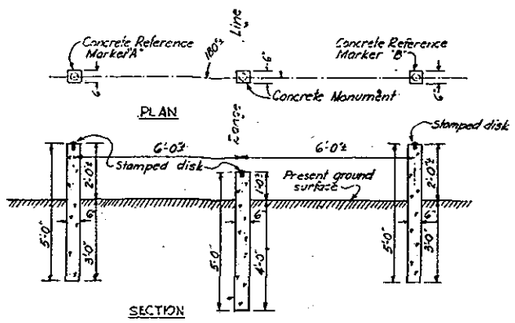
DESIGNED: Kenneth B. Andrew, ENGINEER

DRAWN BY: R. L. J. & M.B.M.
TRACED BY: K.B.W. & L.G.W.
CHECKED BY: J.W.

FILE NO. CT-1-1206

PLATE NO. E-12

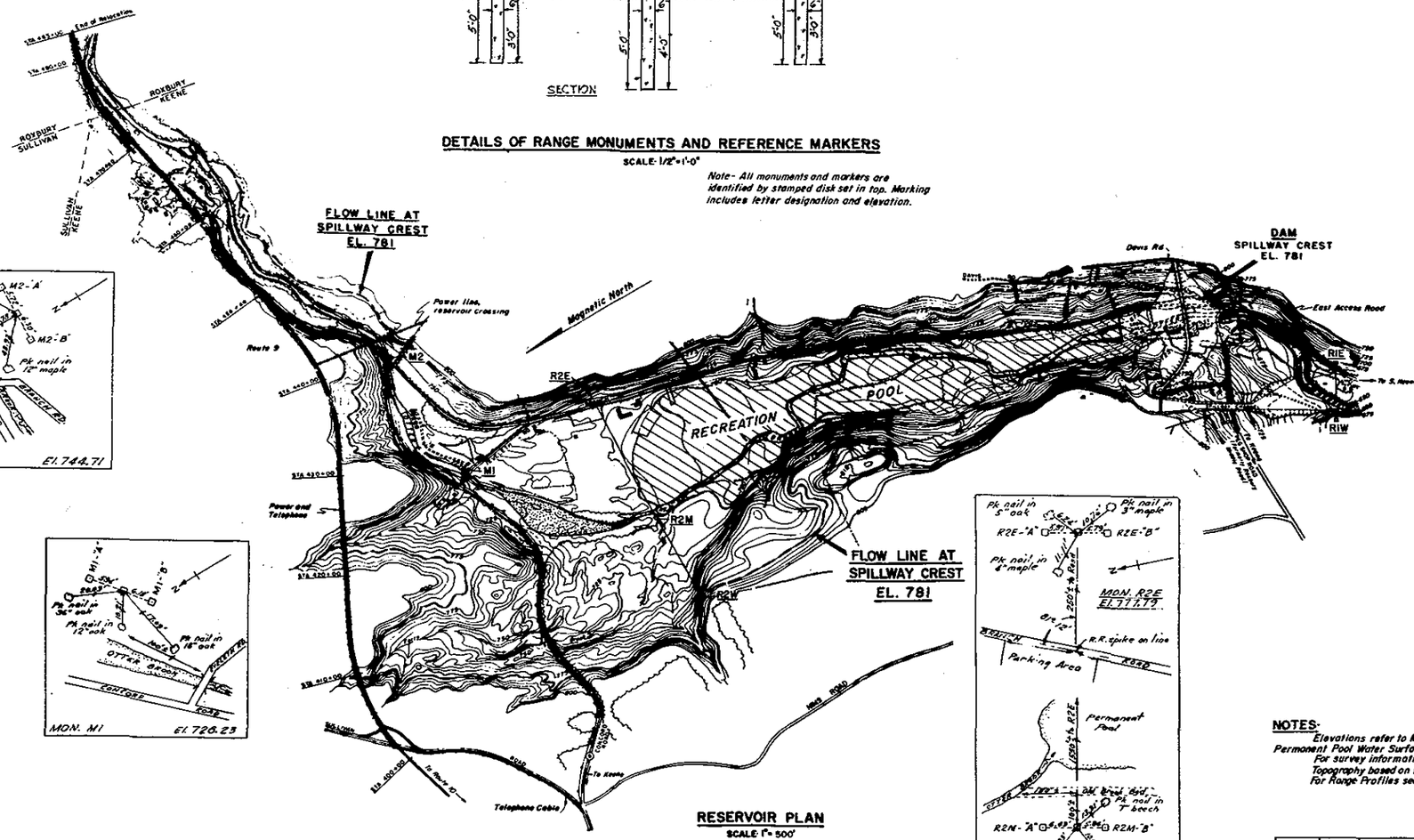
CORPS OF ENGINEERS — U.S. ARMY

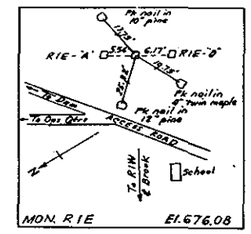


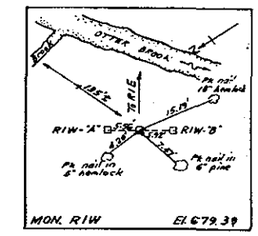
DETAILS OF RANGE MONUMENTS AND REFERENCE MARKERS

SCALE: 1/2" = 1'-0"

Note- All monuments and markers are identified by stamped disk set in top. Marking includes letter designation and elevation.







RESERVOIR PLAN

SCALE: 1" = 500'

NOTES:

Elevations refer to Mean Sea Level Datum (approx.)- based on Permanent Pool Water Surface determined from gage at Dam.
For survey information see Field Books No. FC89 and 186.
Topography based on field survey.
For Range Profiles see Dwg. CT-9-1215, Sh. 2 of 2.

SEDIMENTATION RECORD

DATE OF SURVEY	CHANGE IN AREA AT RANGES – SQ. FT. R1	R2		DEPTH OF SEDIMENT AT MARKERS — FEET R2M	M1	M2					REMARKS
JUNE 1961	—	—		(708.4) 0.0	(727.5) 0.0	(744.0) 0.0					INITIAL SURVEY USABLE RESERVOIR CAPACITY 17,600 AC.FT.

– INDICATES AGRADATION
+ INDICATES DEGRADATION

NOTE- ELEVATION IN (727.5) IS GROUND SURFACE BESIDE MONUMENT

REVISION	DATE	DESCRIPTION

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY K.B.W. | DR. BY K.H.W. | CK. BY

PROJECT ENGINEER

APPROVAL RECOMMENDED
CHIEF, P & R BRANCH

APPROVED
CHIEF, ENGINEERING DIVISION

DATE AUG. 1961

CONNECTICUT RIVER FLOOD CONTROL
OTTER BROOK RESERVOIR
RESERVOIR AND SEDIMENTATION MAP

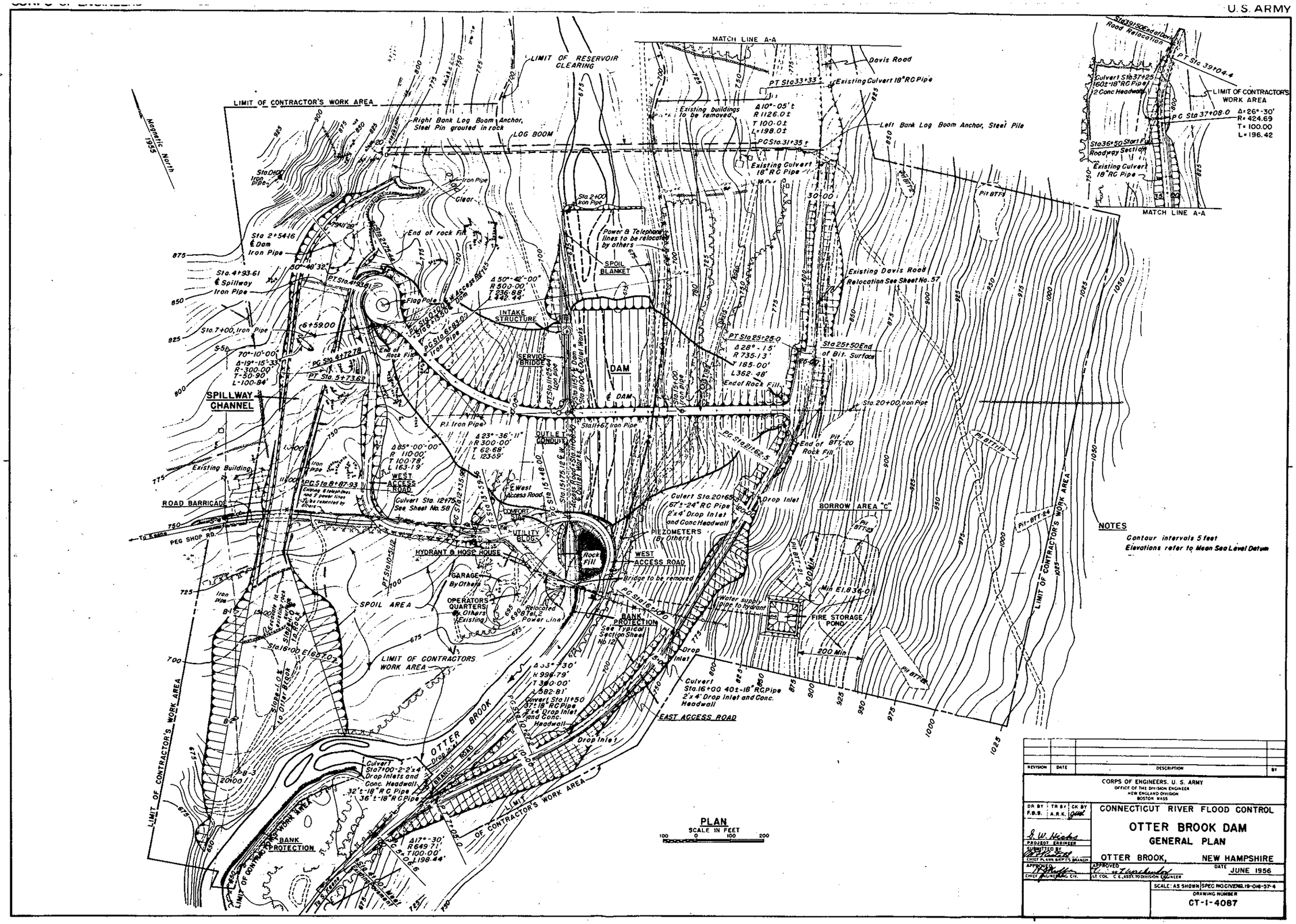
OTTER BROOK — NEW HAMPSHIRE

SCALE: AS SHOWN | SPEC. NO. CIV. ENG. 19-018-

DRAWING NUMBER
CT-9-1214

PLATE NO. E-13

U.S. ARMY



PLAN
SCALE IN FEET
100 0 100 200

NOTES

Contour intervals 5 feet

Elevations refer to Mean Sea Level Datum

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

DR BY	TR BY	CK BY
F.B.S.	A.R.K.	

CONNECTICUT RIVER FLOOD CONTROL

OTTER BROOK DAM
GENERAL PLAN

OTTER BROOK, NEW HAMPSHIRE

J. W. Hicks
PROJECT ENGINEER

SUBMITTED BY
CHIEF PLANS & SPEC'S BRANCH

APPROVED
CHIEF ENGINEERING DIV.

APPROVED
Lt. Col. C.E., ASST. TO DIVISION ENGINEER

DATE JUNE 1956

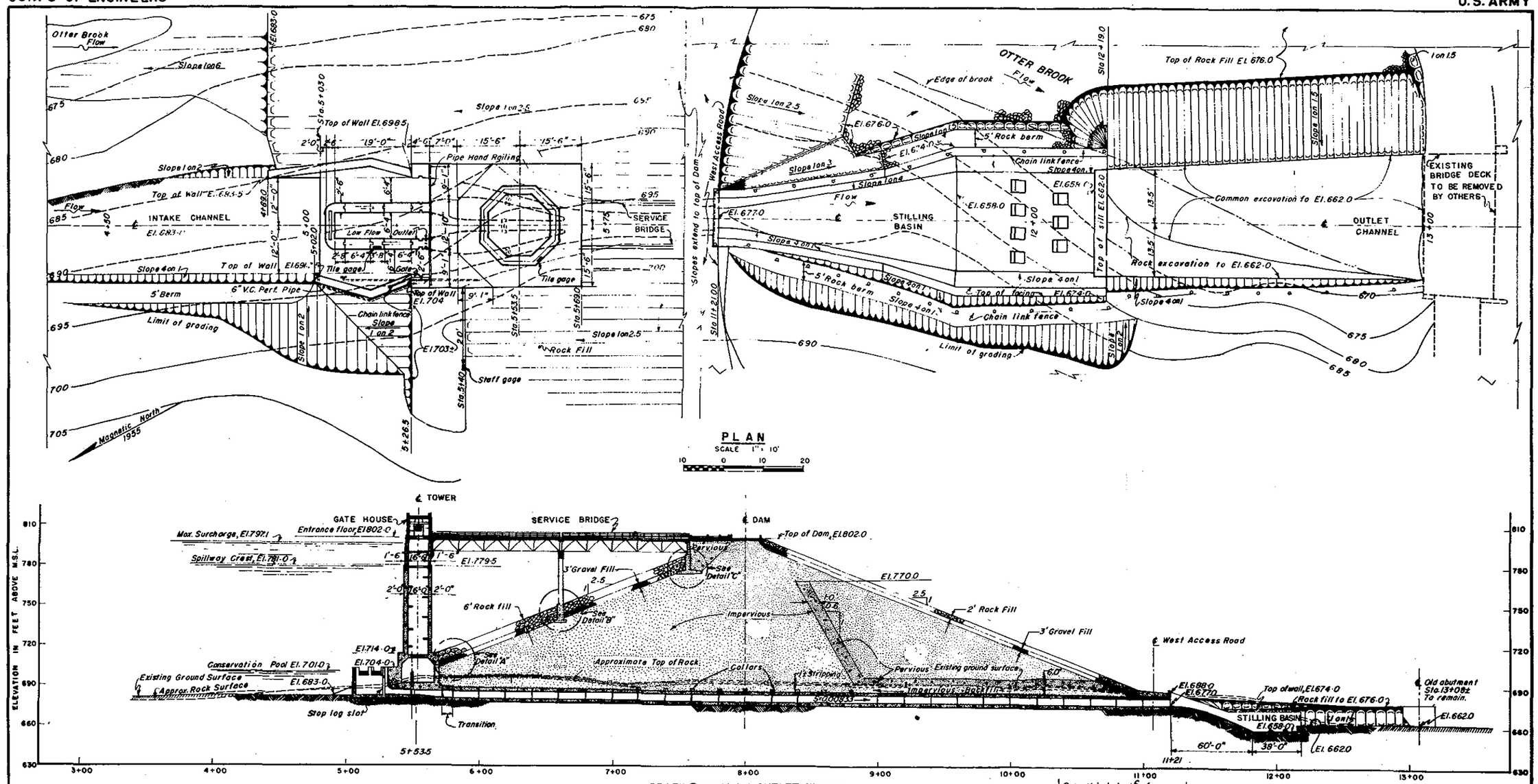
SCALE: AS SHOWN | SPEC. NO. GIVENG. 19-018-37-4

DRAWING NUMBER
CT-1-4087

PLATE NO. E-14

CORPS OF ENGINEERS

U.S. ARMY



NOTES:
Elevations refer to Mean Sea Level Datum

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

DR. BY	TR. BY	CK. BY
F.B.S.	J.P.	Gust

CONNECTICUT RIVER FLOOD CONTROL
OTTER BROOK DAM
OUTLET WORKS
PLAN, PROFILE & SECTIONS
OTTER BROOK NEW HAMPSHIRE

G.W. Hughes
PROJECT ENGINEER
SUBMITTED BY: CHIEF, PLANS & SPECS. BRANCH
APPROVED: CHIEF, ENGINEERING DIV.
APPROVED: C.E. COL. C.E. ARMY DIVISION ENGINEER
DATE JUNE 1956
SCALE AS SHOWN
SPEC. NO. CIV-ENG-19-106-57-4
DRAWING NUMBER
CT-1-4091

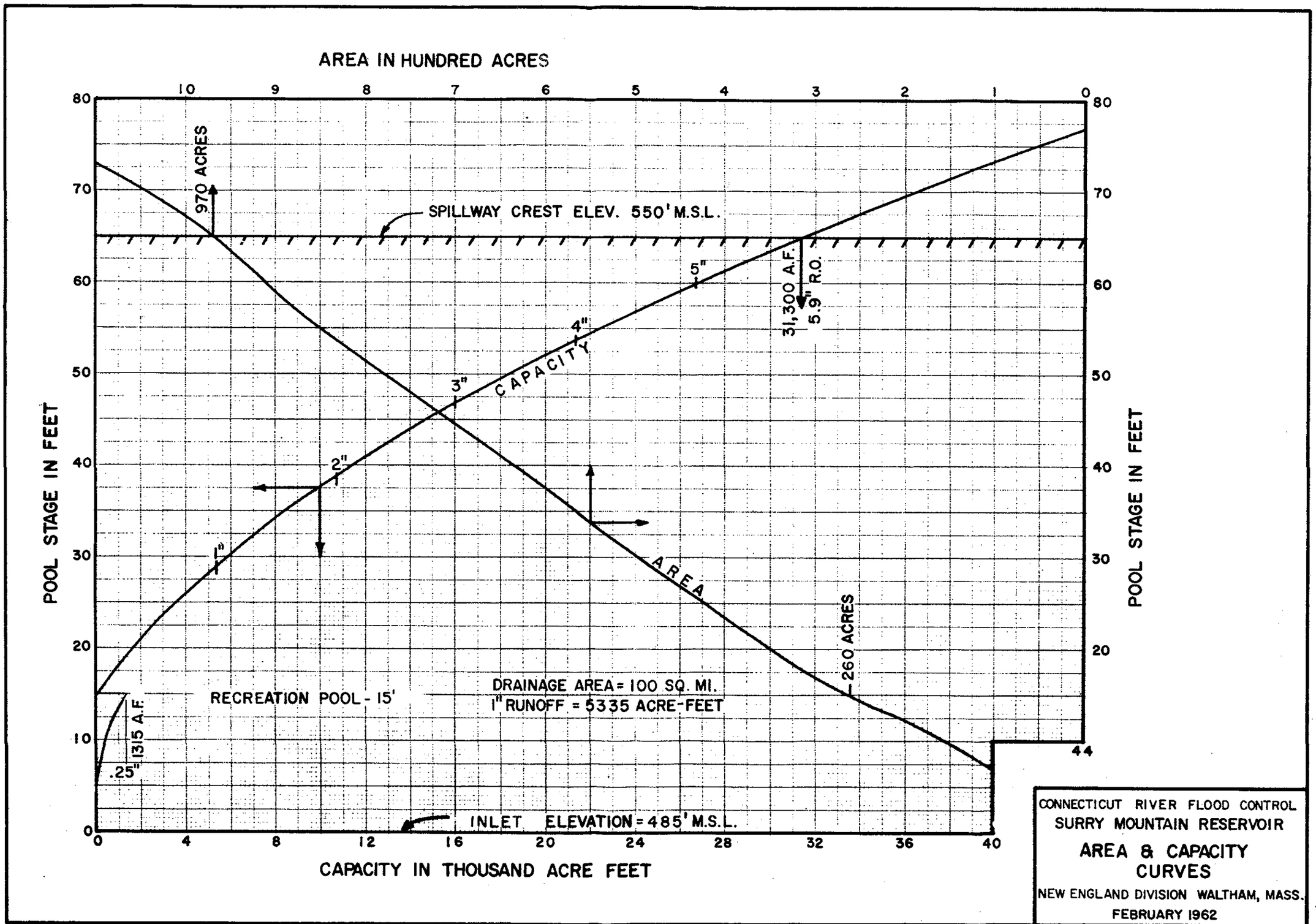
PLATE NO. E-15

SURRY MT. RESERVOIR
AREA AND CAPACITY

DRAINAGE AREA = 100 S.M.

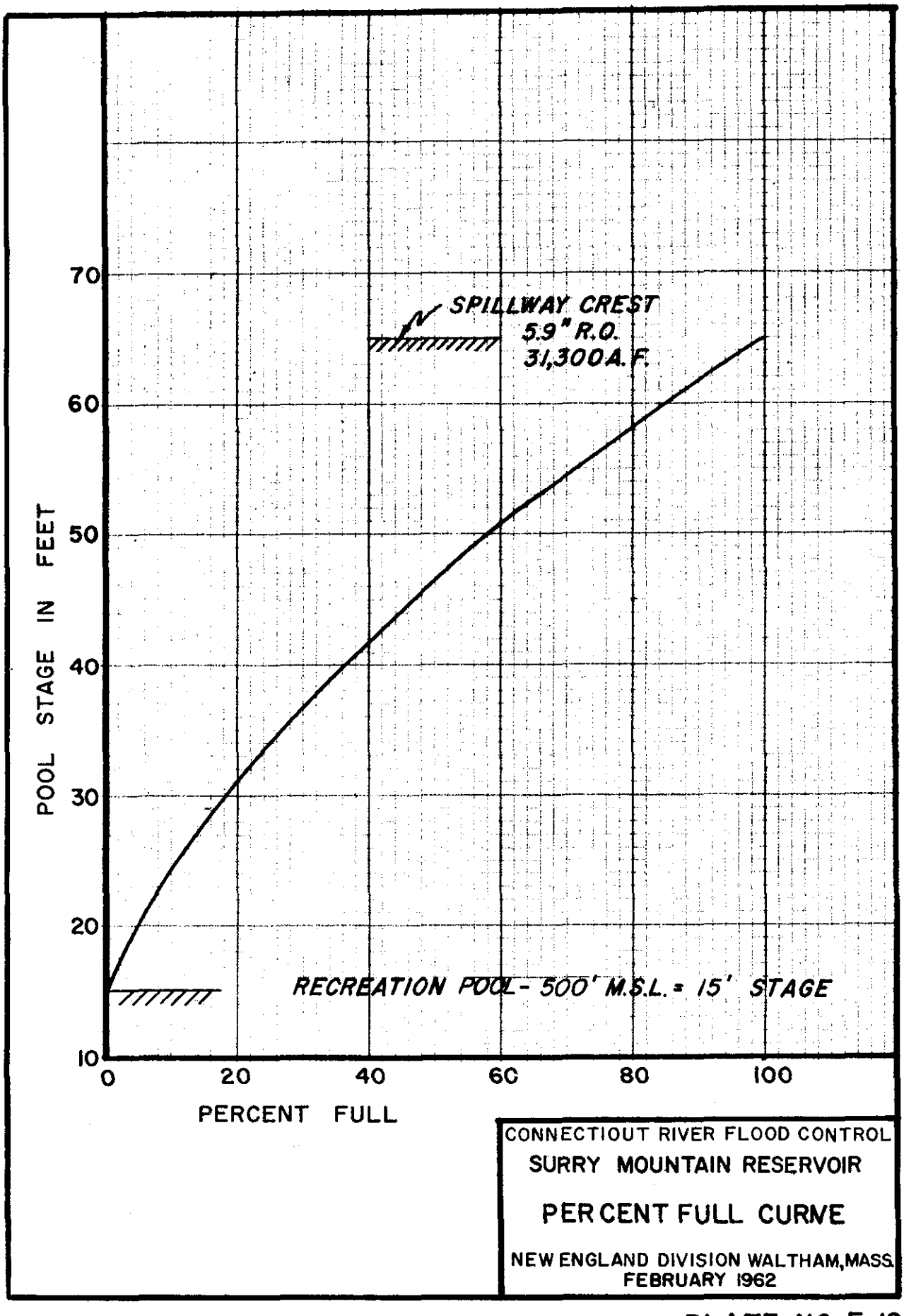
ELEV. M.S.L.	STAGE FEET	AREA ACRES	CAPACITY AC. FT.	CAPACITY INCHES
485	0	0		
486	1	15	5	
487	2	30	12	
488	3	40	22	
489	4	55	32	
490	5	70	42	
491	6	85	62	.01
492	7	100	92	.02
493	8	120	132	.03
494	9	140	243	.05
495	10	155	383	.07
496	11	175	500	.09
497	12	195	700	.13
498	13	215	900	.17
499	14	240	1105	.21
499.5	14.5	250	1200	.23
500	15	260	1317	.25
	RECREATION POOL - 500'			
501	16	278	269	.05
502	17	296	559	.10
503	18	314	864	.16
504	19	332	1187	.22
505	20	350	1528	.29
506	21	364	1885	.35
507	22	378	2256	.42
508	23	392	2641	.49
509	24	407	3041	.57
510	25	423	3456	.65
511	26	438	3887	.73
512	27	453	4333	.81
513	28	468	4794	.90
514	29	483	5270	.99
515	30	498	5761	1.08
516	31	512	6266	1.17
517	32	526	6785	1.27
518	33	540	7318	1.37
519	34	554	7865	1.47
520	35	567	8426	1.58
521	36	580	8999	1.69
522	37	594	9586	1.80
523	38	608	10187	1.91
524	39	621	10802	2.02
525	40	635	11430	2.14
526	41	649	12072	2.26
527	42	664	12729	2.39
528	43	678	13400	2.51
529	44	693	14086	2.64
530	45	708	14786	2.77
531	46	722	15501	2.90
532	47	736	16230	3.04
533	48	750	16973	3.18
534	49	765	17731	3.32
535	50	780	18503	3.47
536	51	794	19290	3.61
537	52	808	20091	3.77
538	53	822	20906	3.92
539	54	836	21735	4.07
540	55	850	22578	4.23
541	56	862	23434	4.39
542	57	874	24302	4.55
543	58	887	25183	4.72
544	59	900	26076	4.89
545	60	913	26983	5.06
546	61	925	27902	5.23
547	62	937	28833	5.40
548	63	948	29776	5.58
549	64	959	30729	5.76
550	65	970	31694	5.94
	CREST ELEVATION - 550'			
551	66	986	32672	6.12
552	67	1002	33666	6.31
553	68	1018	34676	6.50
554	69	1034	35702	6.69
555	70	1050	36744	6.89
556	71	1067	37802	7.08
557	72	1084	38878	7.29
558	73	1100	39970	7.49

PLATE NO.E-16



CONNECTICUT RIVER FLOOD CONTROL
SURRY MOUNTAIN RESERVOIR
AREA & CAPACITY CURVES
NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRUARY 1962

PLATE NO. E-17



CONNECTIOUT RIVER FLOOD CONTROL

SURRY MOUNTAIN RESERVOIR

PERCENT FULL CURVE

NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRUARY 1962

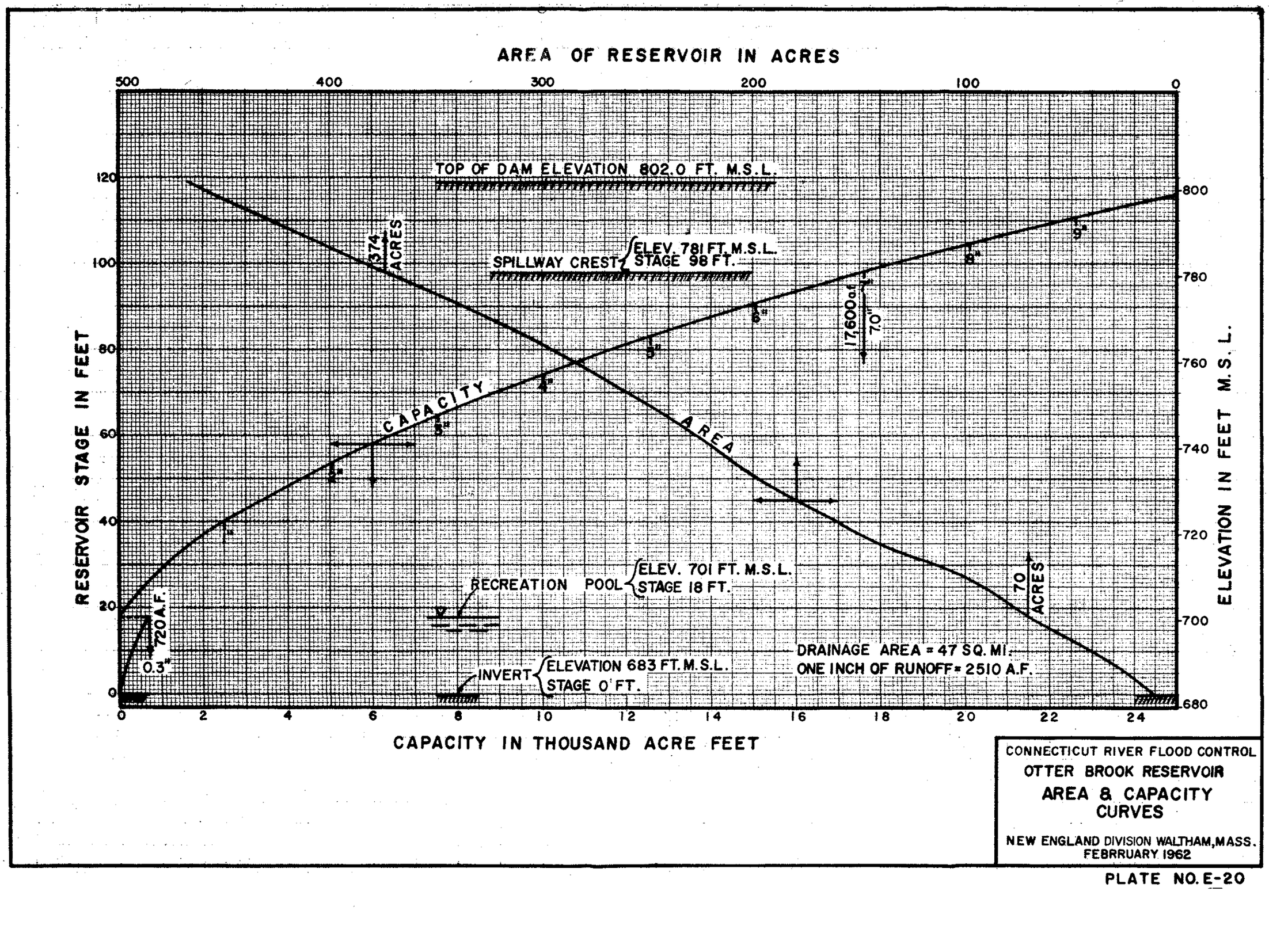
PLATE NO. E-18

OTTER BROOK RESERVOIR
AREA AND CAPACITY

DRAINAGE AREA = 47 S.M.

ELEV. M.S.L.	STAGE FEET	AREA ACRES	CAPACITY AC. FT.	CAPACITY INCHES	ELEV. M.S.L.	STAGE FEET	AREA ACRES	CAPACITY AC. FT.	CAPACITY INCHES
683	0	11	40	.02	739	56	214	5500	2.19
685	2	16	70	.03	741	58	219	5930	2.36
687	4	22	110	.04	743	60	226	6370	2.54
689	6	27	160	.06	745	62	232	6830	2.78
691	8	32	210	.09	747	64	239	7300	2.91
693	10	40	290	.11	749	66	245	7790	3.10
695	12	47	370	.15	751	68	252	8280	3.30
697	14	55	480	.19	753	70	259	8790	3.51
699	16	62	590	.24	755	72	266	9280	3.71
701	18	70	720	.29	757	74	273	9880	3.93
	Recreation Pool = 701				759	76	280	10480	4.15
701	18	70	0	0	761	78	288	10980	4.38
703	20	76	150	.06	763	80	296	11580	4.61
705	22	83	310	.12	765	82	303	12180	4.85
707	24	90	480	.19	767	84	311	12780	5.09
709	26	96	670	.26	769	86	319	13380	5.35
711	28	103	870	.34	771	88	327	14080	5.57
713	30	113	1080	.43	773	90	336	14680	5.87
715	32	123	1320	.52	775	92	346	15380	6.14
717	34	133	1580	.63	777	94	355	16080	6.42
719	36	143	1850	.74	779	96	365	16780	6.70
721	38	153	2150	.85	781	98	374	17600	7.00
723	40	161	2460	.98		Crest Elevation = 781			
725	42	169	2790	1.11	783	100	383	18280	7.30
727	44	177	3140	1.25	785	102	392	19080	7.61
729	46	184	3500	1.39	787	104	400	19880	7.93
731	48	192	3870	1.54	789	106	409	20680	8.25
733	50	197	4260	1.70	791	108	418	21480	8.58
735	52	203	4660	1.86	793	110	427	22380	8.92
737	54	208	5070	2.02	795	112	435	23180	9.26
					797	114	444	24080	9.61

PLATE NO. E-19



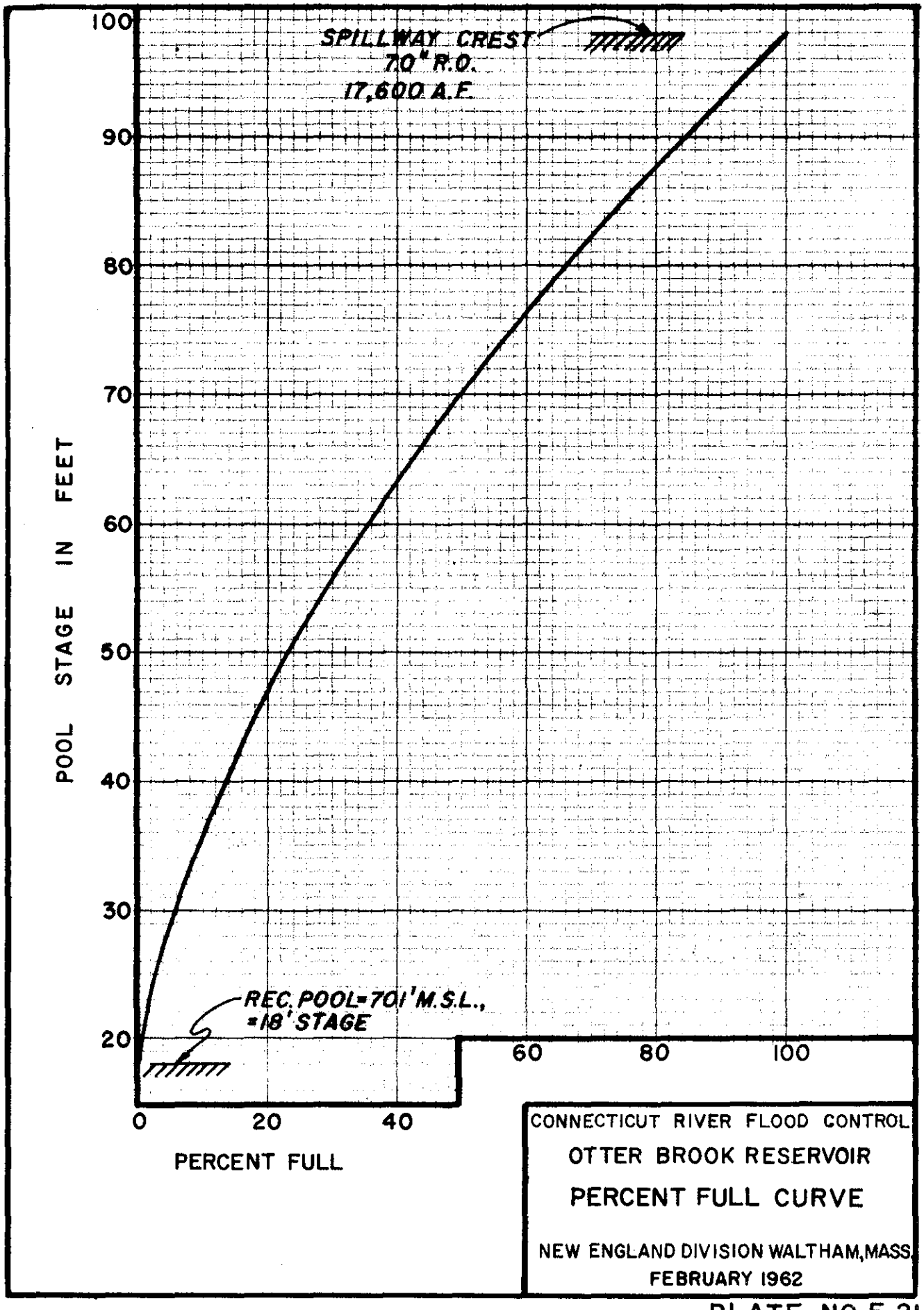
CONNECTICUT RIVER FLOOD CONTROL

OTTER BROOK RESERVOIR

AREA & CAPACITY CURVES

NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRRUARY 1962

PLATE NO. E-20



CONNECTICUT RIVER FLOOD CONTROL

OTTER BROOK RESERVOIR

PERCENT FULL CURVE

NEW ENGLAND DIVISION WALTHAM, MASS.

FEBRUARY 1962

PLATE NO. E-21

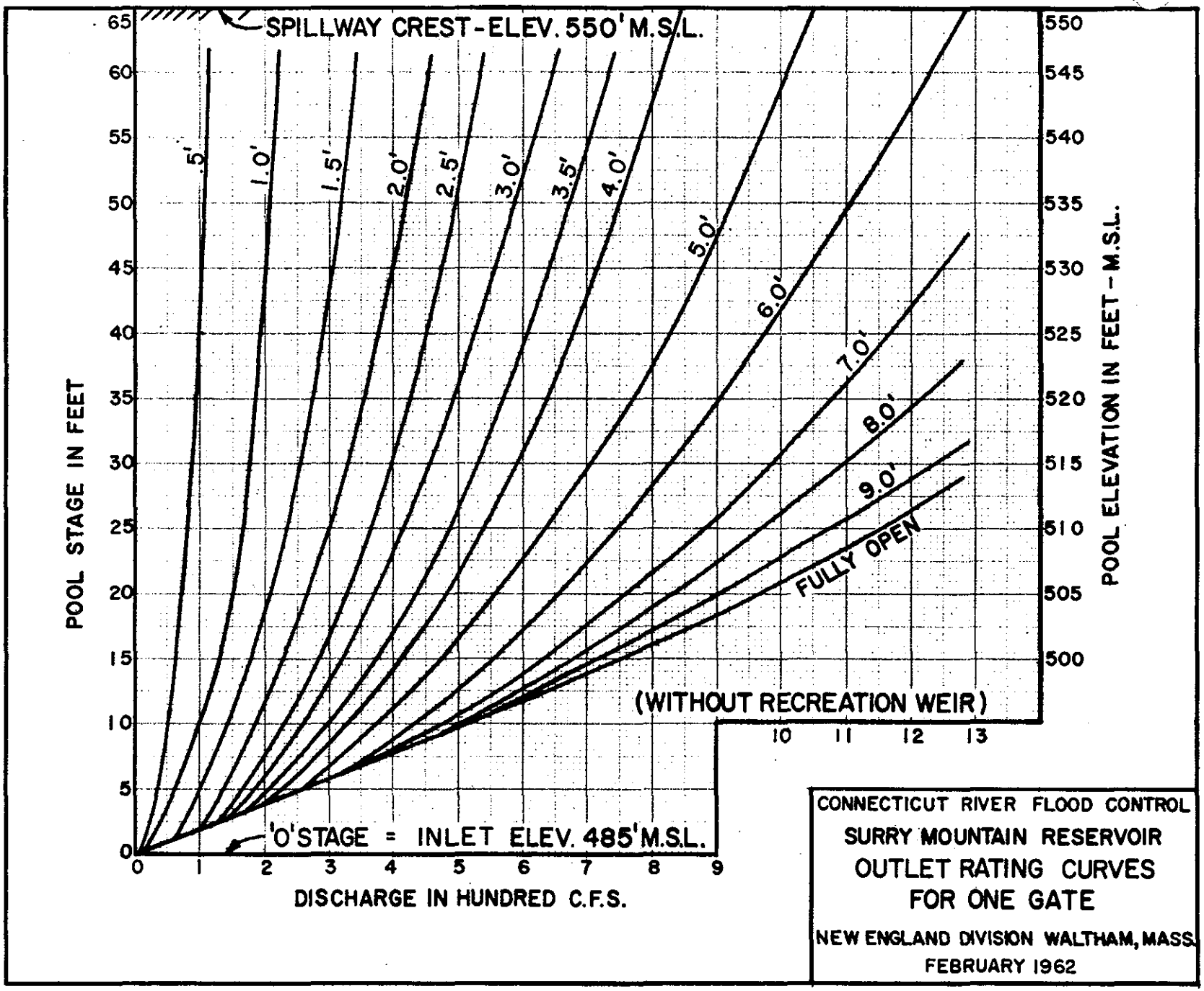
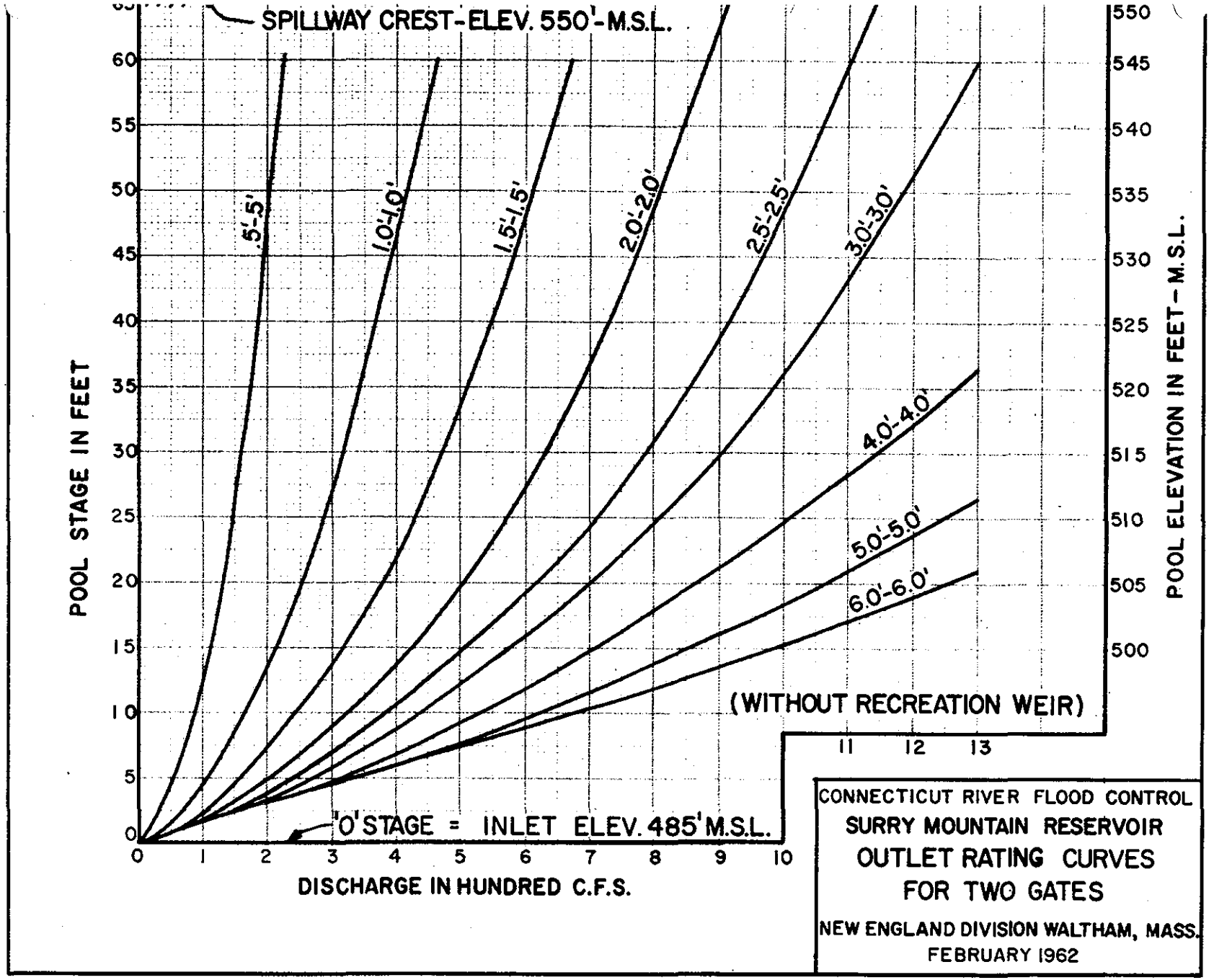
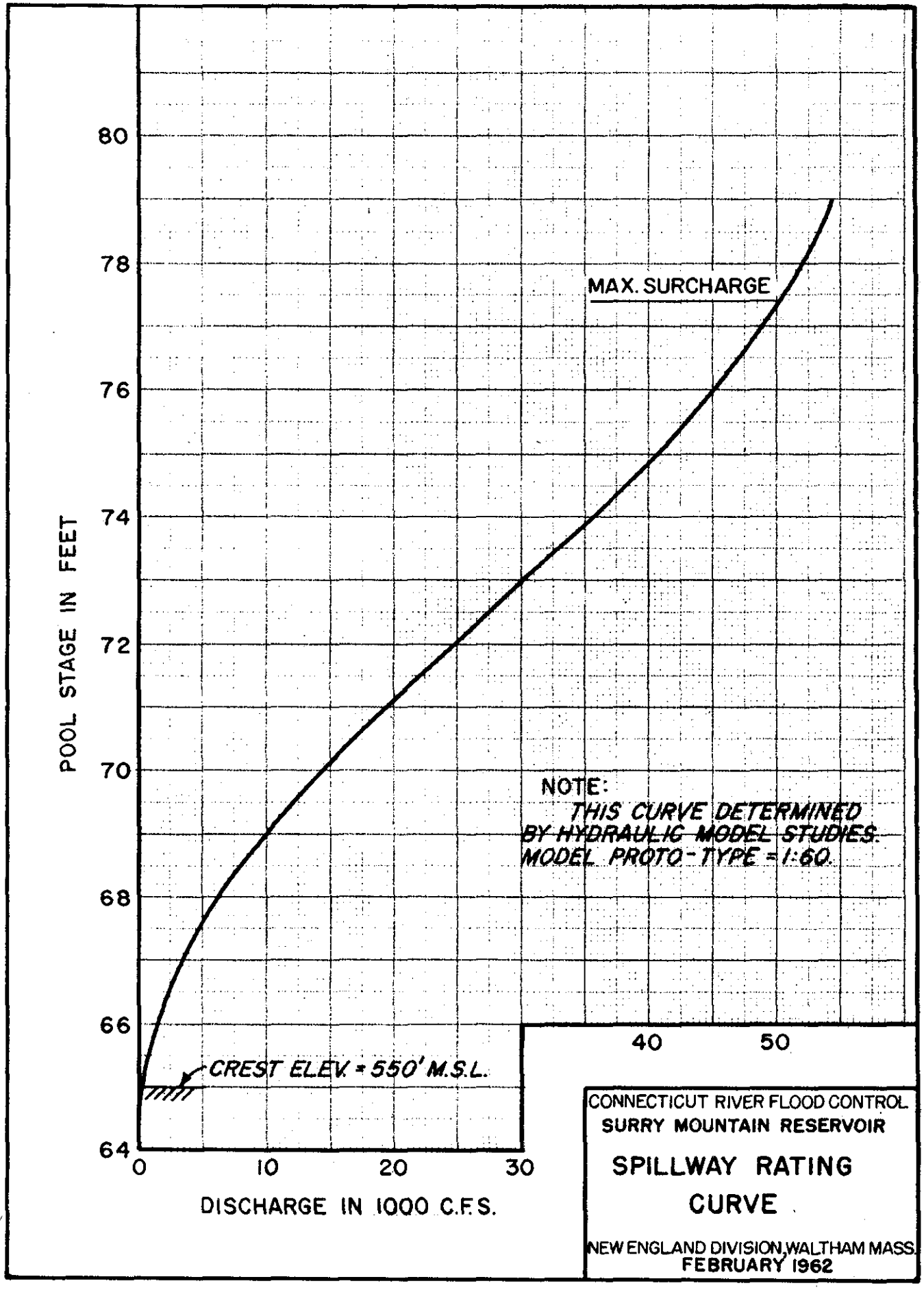

SPILLWAY CREST - ELEV. 550' M.S.L.
5'
1.0'
1.5'
2.0'
2.5'
3.0'
3.5'
4.0'
5.0'
6.0'
7.0'
8.0'
9.0'
FULLY OPEN
(WITHOUT RECREATION WEIR)
'0' STAGE = INLET ELEV. 485' M.S.L.
POOL STAGE IN FEET
POOL ELEVATION IN FEET - M.S.L.
DISCHARGE IN HUNDRED C.F.S.
0 1 2 3 4 5 6 7 8 9 10 11 12 13
0 5 10 15 20 25 30 35 40 45 50 55 60 65
500 505 510 515 520 525 530 535 540 545 550
CONNECTICUT RIVER FLOOD CONTROL
SURRY MOUNTAIN RESERVOIR
OUTLET RATING CURVES
FOR ONE GATE
NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRUARY 1962

PLATE NO. E-22



CONNECTICUT RIVER FLOOD CONTROL
SURRY MOUNTAIN RESERVOIR
OUTLET RATING CURVES
FOR TWO GATES
NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRUARY 1962

PLATE NO. E-23



CONNECTICUT RIVER FLOOD CONTROL
SURRY MOUNTAIN RESERVOIR

SPILLWAY RATING CURVE

NEW ENGLAND DIVISION, WALTHAM MASS.
FEBRUARY 1962

PLATE NO. E-24

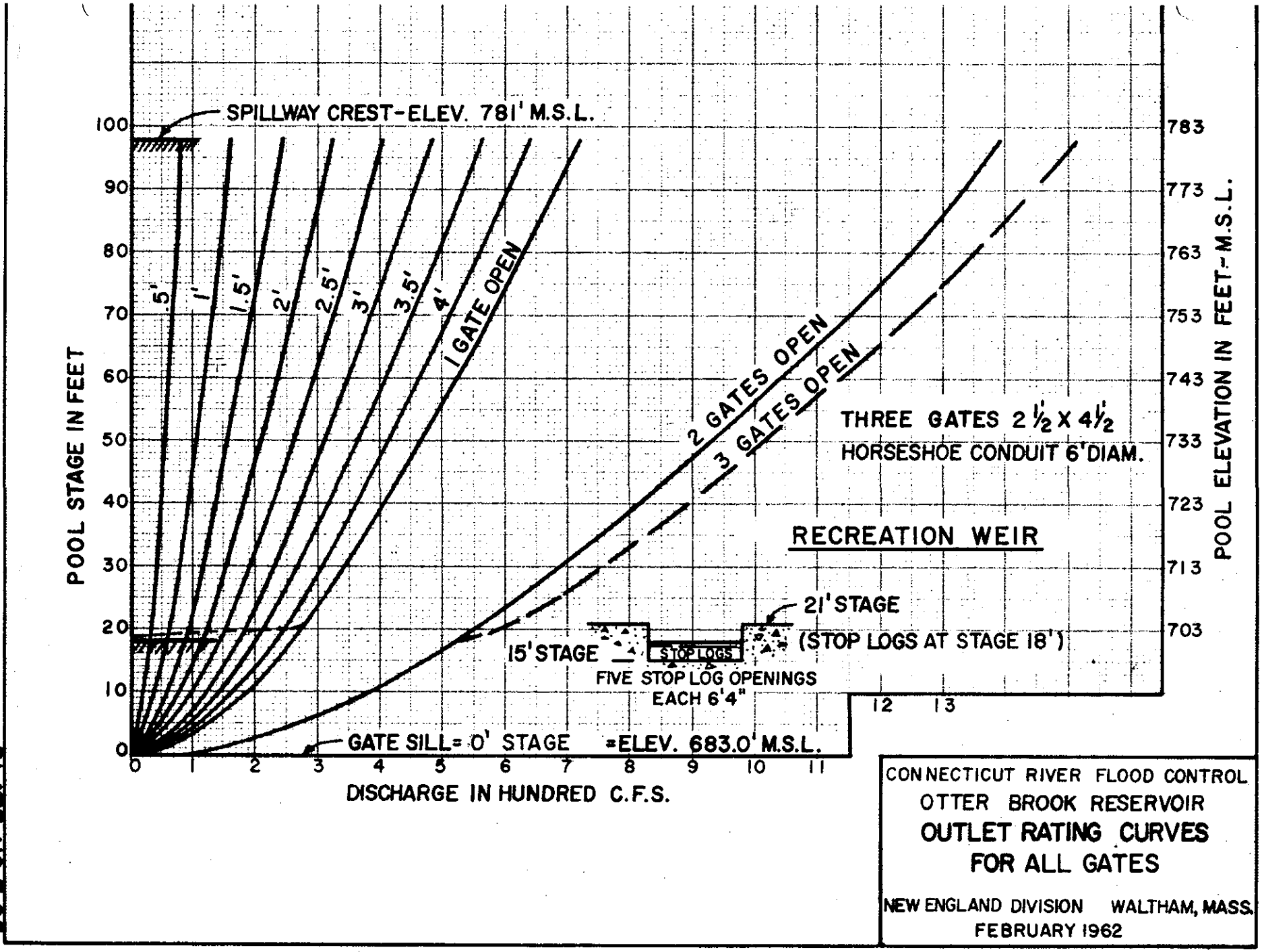


PLATE NO. E-25

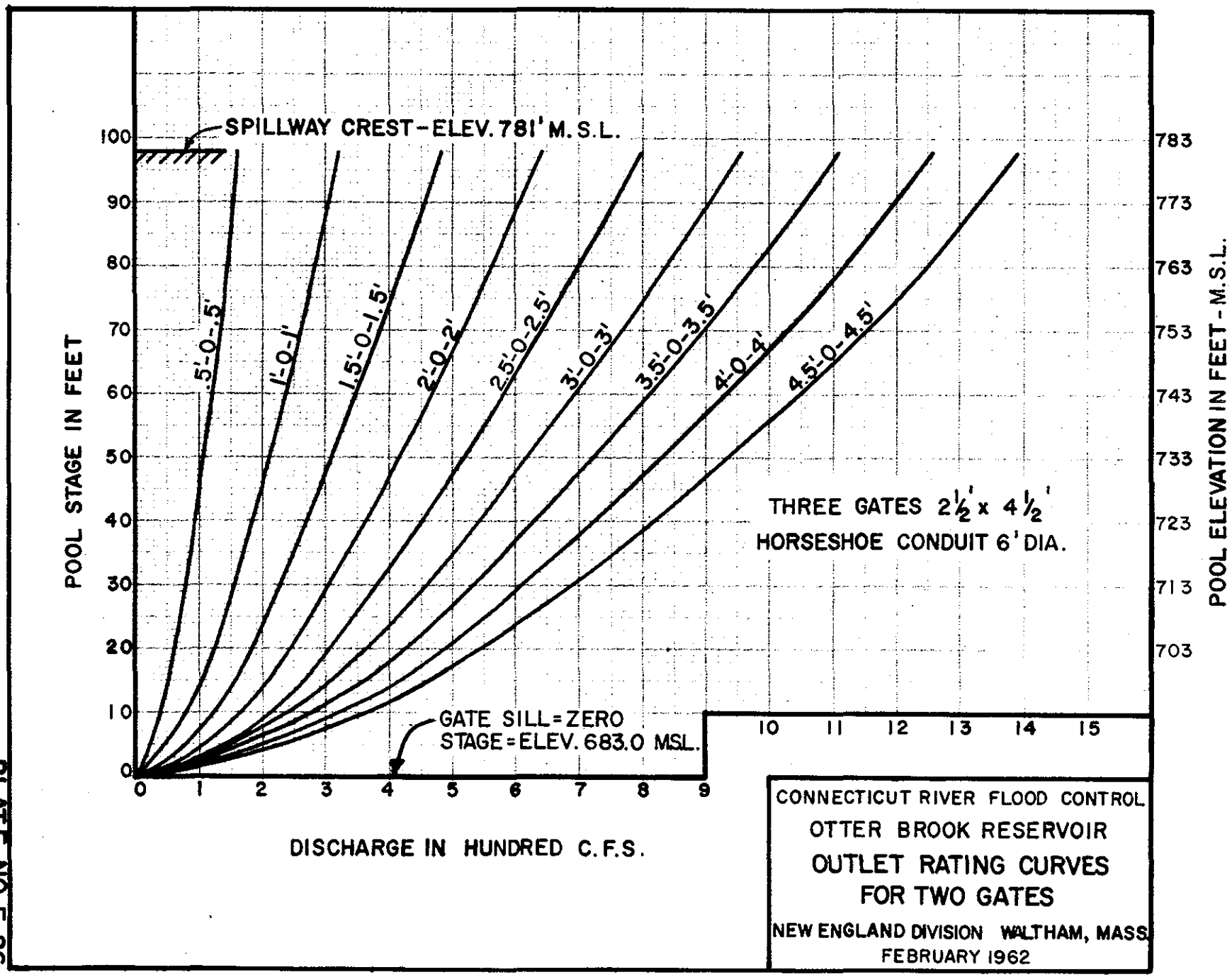
CONNECTICUT RIVER FLOOD CONTROL

OTTER BROOK RESERVOIR

OUTLET RATING CURVES FOR ALL GATES

NEW ENGLAND DIVISION WALTHAM, MASS.

FEBRUARY 1962



CONNECTICUT RIVER FLOOD CONTROL

OTTER BROOK RESERVOIR

OUTLET RATING CURVES FOR TWO GATES

NEW ENGLAND DIVISION WALTHAM, MASS.

FEBRUARY 1962

PLATE NO. E-26

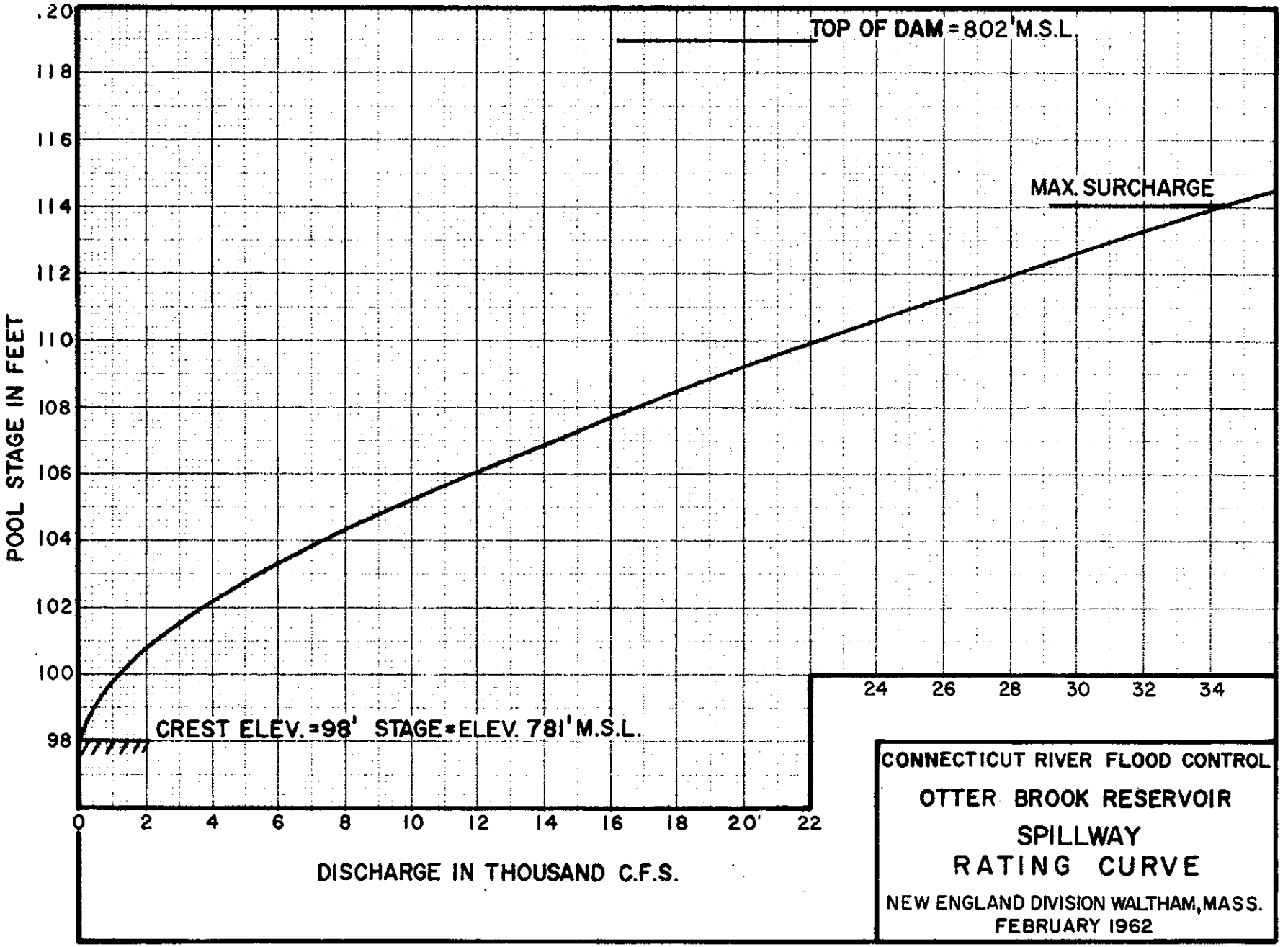

TOP OF DAM = 802' M.S.L.
MAX. SURCHARGE
CREST ELEV. = 98' STAGE = ELEV. 781' M.S.L.
POOL STAGE IN FEET
120
118
116
114
112
110
108
106
104
102
100
98
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
DISCHARGE IN THOUSAND C.F.S.
CONNECTICUT RIVER FLOOD CONTROL
OTTER BROOK RESERVOIR
SPILLWAY
RATING CURVE
NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRUARY 1962

PLATE NO. E-27

9-210
(Nov. 1957)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

File No. { Washington
Field

Rating table for Ashuelot River below Surry Mountain Dam, near Keene, N.H.

, *from* Oct. 1, 1960, *to* , 19, *from* , 19, *to* , 19

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
4.00			6.00	187		.00			.00			.00			.00			.00		
.10			.10	211		.10			.10			.10			.10			.10		
.20			.20	237		.20			.20			.20			.20			.20		
.30			.30	265		.30			.30			.30			.30			.30		
.40			.40	295		.40			.40			.40			.40			.40		
.50			.50	325		.50			.50			.50			.50			.50		
.60	9		.60	355		.60			.60			.60			.60			.60		
.70	14		.70	388		.70			.70			.70			.70			.70		
.80	19		.80	421		.80			.80			.80			.80			.80		
.90	26		.90	455		.90			.90			.90			.90			.90		
5.00	34		7.00	490		.00			.00			.00			.00			.00		
.10	42		.10	525		.10			.10			.10			.10			.10		
.20	52		.20	565		.20			.20			.20			.20			.20		
.30	64		.30	605		.30			.30			.30			.30			.30		
.40	77		.40	645		.40			.40			.40			.40			.40		
.50	91		.50	685		.50			.50			.50			.50			.50		
.60	107		.60	725		.60			.60			.60			.60			.60		
.70	124		.70	765		.70			.70			.70			.70			.70		
.80	143		.80	805		.80			.80			.80			.80			.80		
.90	164		.90			.90			.90			.90			.90			.90		

This table is applicable for open-channel conditions. It is based on ..... discharge measurements made during .....

..... and is ..... well defined between ..... cfs and ..... cfs. Comp by ..... date .....

..... Ckd by ..... date .....

..... Table No. .....

PLATE NO. E-28

9-210
(Nov. 1957)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

File No. { Washington
Field

Rating table for Otter Brook below Otter Brook Dam, near Keene, N.H.

....., *from* Apr. 20, 1959, *to* ....., 19....., *from* ....., 19....., *to* ....., 19.....

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
5.00			7.00	138		.00			.00			.00			.00			.00		
.10			.10	158		.10			.10			.10			.10			.10		
.20			.20	183		.20			.20			.20			.20			.20		
.30			.30	208		.30			.30			.30			.30			.30		
.40			.40	238		.40			.40			.40			.40			.40		
.50			.50	268		.50			.50			.50			.50			.50		
.60			.60	298		.60			.60			.60			.60			.60		
.70			.70	328		.70			.70			.70			.70			.70		
.80	7		.80	358		.80			.80			.80			.80			.80		
.90	10		.90	393		.90			.90			.90			.90			.90		
6.00	15		8.00	430		.00			.00			.00			.00			.00		
.10	21		.10	470		.10			.10			.10			.10			.10		
.20	27		.20	510		.20			.20			.20			.20			.20		
.30	35		.30	550		.30			.30			.30			.30			.30		
.40	44		.40	595		.40			.40			.40			.40			.40		
.50	55		.50	640		.50			.50			.50			.50			.50		
.60	67		.60	690		.60			.60			.60			.60			.60		
.70	81		.70			.70			.70			.70			.70			.70		
.80	98		.80			.80			.80			.80			.80			.80		
.90	118		.90			.90			.90			.90			.90			.90		

This table is applicable for open-channel conditions. It is based on ..... discharge measurements made during .....

..... and is ..... well defined between ..... cfs and ..... cfs. Comp by ..... date .....

..... Ckd by ..... date .....

..... Table No. .....

PLATE NO. E-29

(Nov. 1957)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

File No. { Washington ..... Field .....

Rating table for Ashuelot River near Gilsom, N.H.

....., *from* Apr. 3, 1959, *to* ....., 19....., *from* ....., 19....., *to* ....., 19.....

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*
1.00			3.00	173		5.00	715		7.00	1530		.00			.00			.00		
.10			.10	191		.10	750		.10	1580		.10			.10			.10		
.20			.20	210		.20	785		.20	1630		.20			.20			.20		
.30			.30	230		.30	820		.30	1680		.30			.30			.30		
.40			.40	251		.40	855		.40	1730		.40			.40			.40		
.50	11		.50	273		.50	890		.50	1785		.50			.50			.50		
.60	15		.60	296		.60	925		.60	1840		.60			.60			.60		
.70	20		.70	320		.70	960		.70	1900		.70			.70			.70		
.80	26		.80	344		.80	995		.80	1960		.80			.80			.80		
.90	34		.90	369		.90	1030		.90	2020		.90			.90			.90		
2.00	42		4.00	394		6.00	1065		8.00	2080		.00			.00			.00		
.10	52		.10	420		.10	1100		.10	2140		.10			.10			.10		
.20	62		.20	447		.20	1140		.20	2200		.20			.20			.20		
.30	73		.30	475		.30	1185		.30	2265		.30			.30			.30		
.40	85		.40	505		.40	1230		.40	2330		.40			.40			.40		
.50	98		.50	540		.50	1280		.50	2395		.50			.50			.50		
.60	111		.60	575		.60	1330		.60	2460		.60			.60			.60		
.70	125		.70	610		.70	1380		.70			.70			.70			.70		
.80	140		.80	645		.80	1430		.80			.80			.80			.80		
.90	156		.90	680		.90	1480		.90			.90			.90			.90		

This table is applicable for open-channel conditions. It is based on ..... discharge measurements made during .....

..... and is ..... well defined between ..... cfs and ..... cfs. Comp by ..... date .....

..... Ckd by ..... date .....

..... Table No. .....

PLATE NO. E-30

9-210
(Nov. 1957)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

File No. { Washington
Field

Rating table for South Branch Ashuelot River at Webb, near Marlboro, N.H.

....., *from* Nov. 22, 19 56, *to* Apr. 16, 19 58, *from* Apr. 3, 19 59, *to* ....., 19....

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*	*Feet*	*Cfs*	*Cfs*
1.00			3.00	40		5.00	555		7.00	3300		.00			.00			.00		
.10			.10	43		.10	615		.10	3550		.10			.10			.10		
.20			.20	47		.20	680		.20	3800		.20			.20			.20		
.30			.30	51		.30	750		.30	4050		.30			.30			.30		
.40			.40	55		.40	830		.40	4350		.40			.40			.40		
.50			.50	60		.50	920		.50	4650		.50			.50			.50		
.60			.60	66		.60	1010		.60	4950		.60			.60			.60		
.70			.70	75		.70	1110		.70	5300		.70			.70			.70		
.80			.80	86		.80	1220		.80	5650		.80			.80			.80		
.90			.90	101		.90	1340		.90	6000		.90			.90			.90		
2.00	8		4.00	122		6.00	1470		8.00			.00			.00			.00		
.10	10		.10	140		.10	1610		.10			.10			.10			.10		
.20	13		.20	180		.20	1760		.20			.20			.20			.20		
.30	16		.30	215		.30	1910		.30			.30			.30			.30		
.40	19		.40	255		.40	2070		.40			.40			.40			.40		
.50	23		.50	300		.50	2250		.50			.50			.50			.50		
.60	26		.60	350		.60	2450		.60			.60			.60			.60		
.70	29		.70	400		.70	2650		.70			.70			.70			.70		
.80	33		.80	450		.80	2850		.80			.80			.80			.80		
.90	36		.90	500		.90	3050		.90			.90			.90			.90		

This table is applicable for open-channel conditions. It is based on ..... discharge measurements made during .....

..... and is ..... well defined between ..... cfs and ..... cfs. Comp by ..... date .....

..... Ckd by ..... date .....

..... Table No. .....

PLATE NO. E-31

9-210
(Nov. 1957)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

File No. { Washington
Field

Rating table for Ashuelot River at Hinsdale, N.H.

....., *from* Oct. 1, 1956, *to* ....., 19....., *from* ....., 19....., *to* ....., 19.....

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
2.00			4.00	385		6.00	2170		8.00	5990		.00			.00			.00		
.10			.10	445		.10	2310		.10	6220		.10			.10			.10		
.20			.20	505		.20	2460		.20			.20			.20			.20		
.30			.30	570		.30	2610		.30			.30			.30			.30		
.40			.40	635		.40	2760		.40			.40			.40			.40		
.50	18.5		.50	700		.50	2920		.50			.50			.50			.50		
.60	24.5		.60	770		.60	3080		.60			.60			.60			.60		
.70	31.5		.70	840		.70	3250		.70			.70			.70			.70		
.80	40.5		.80	915		.80	3420		.80			.80			.80			.80		
.90	51		.90	990		.90	3600		.90			.90			.90			.90		
3.00	64		5.00	1070		7.00	3790		9.00			.00			.00			.00		
.10	79		.10	1150		.10	3990		.10			.10			.10			.10		
.20	97		.20	1240		.20	4190		.20			.20			.20			.20		
.30	118		.30	1340		.30	4400		.30			.30			.30			.30		
.40	143		.40	1440		.40	4620		.40			.40			.40			.40		
.50	172		.50	1550		.50	4840		.50			.50			.50			.50		
.60	205		.60	1670		.60	5070		.60			.60			.60			.60		
.70	242		.70	1790		.70	5300		.70			.70			.70			.70		
.80	283		.80	1910		.80	5530		.80			.80			.80			.80		
.90	330		.90	2040		.90	5760		.90			.90			.90			.90		

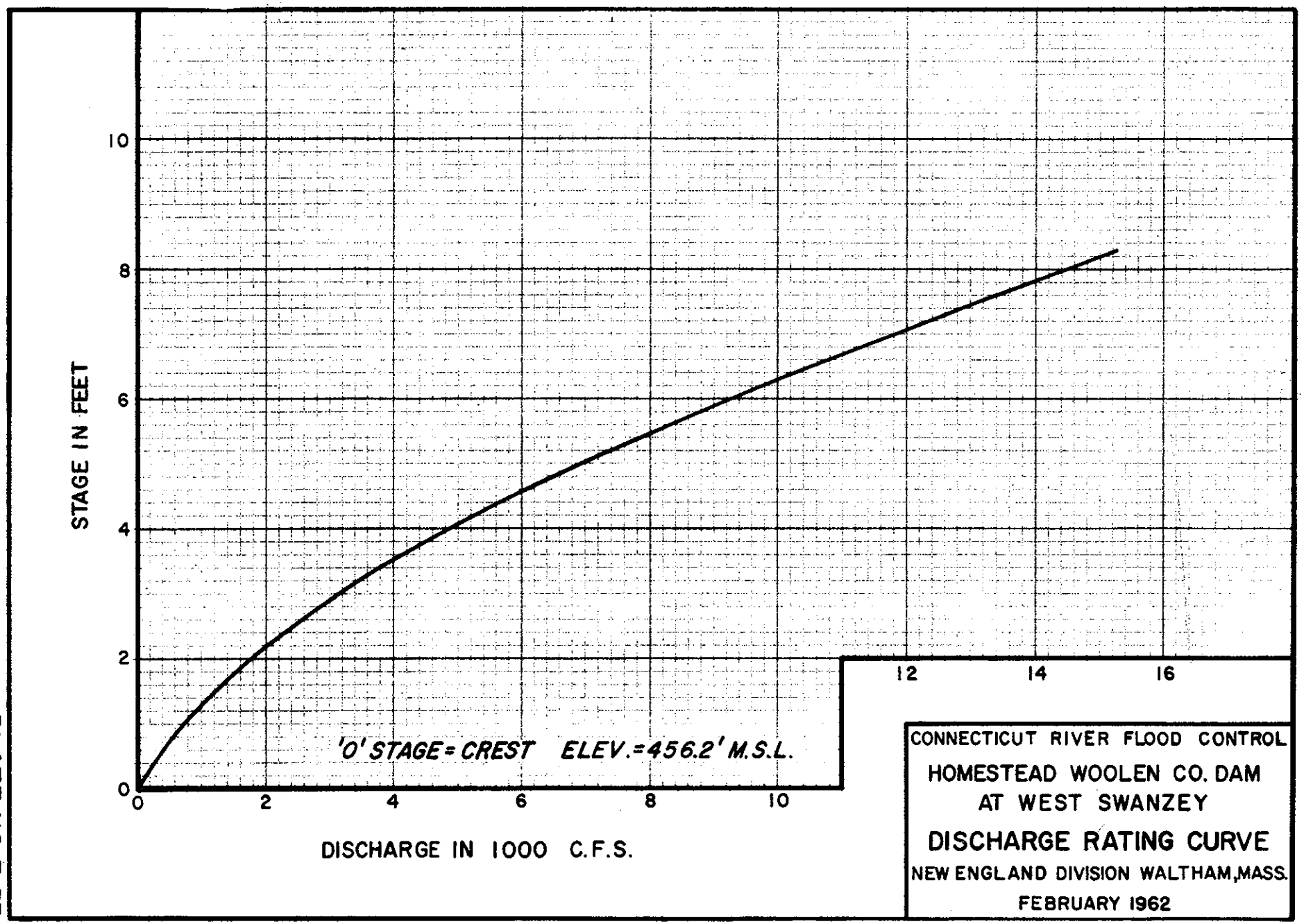
This table is applicable for open-channel conditions. It is based on ..... discharge measurements made during .....

..... and is ..... well defined between ..... cfs and ..... cfs. Comp by ..... date .....

..... Ckd by ..... date .....

..... Table No. .....

PLATE NO. E-32



CONNECTICUT RIVER FLOOD CONTROL

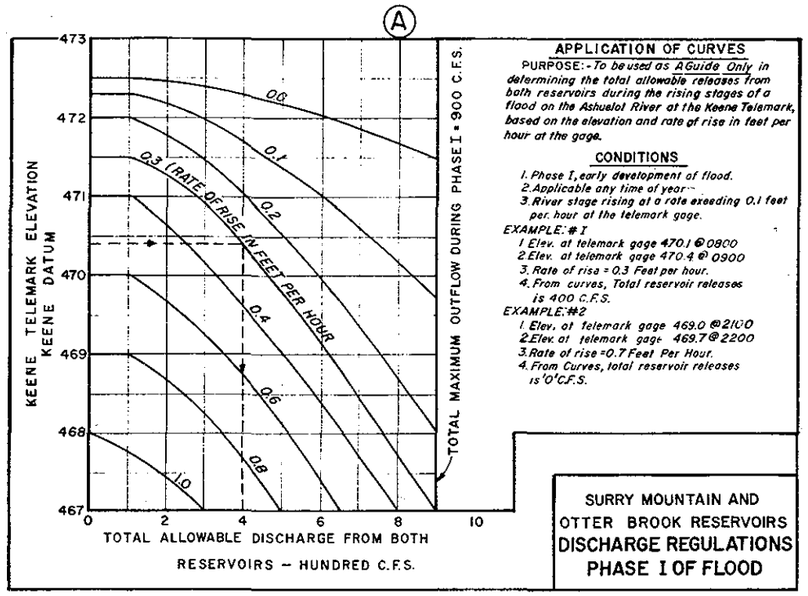
HOMESTEAD WOOLEN CO. DAM
AT WEST SWANZEY

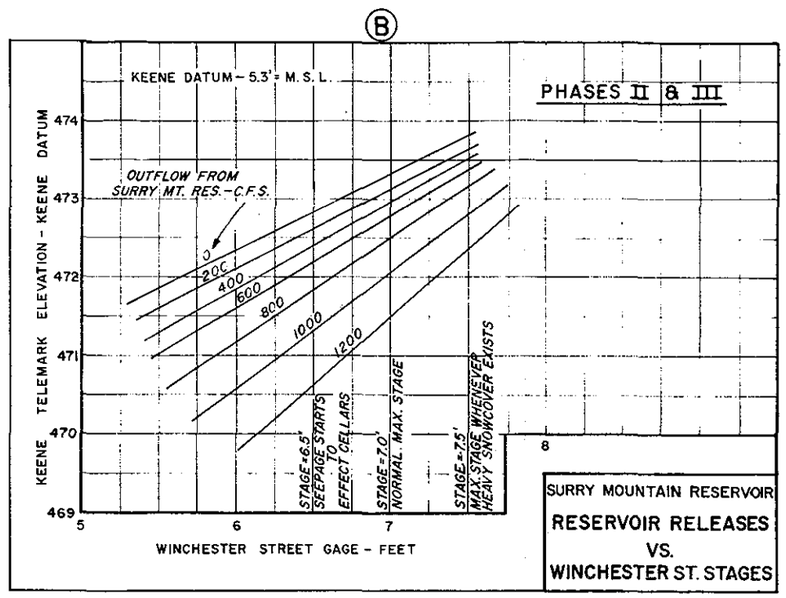
DISCHARGE RATING CURVE

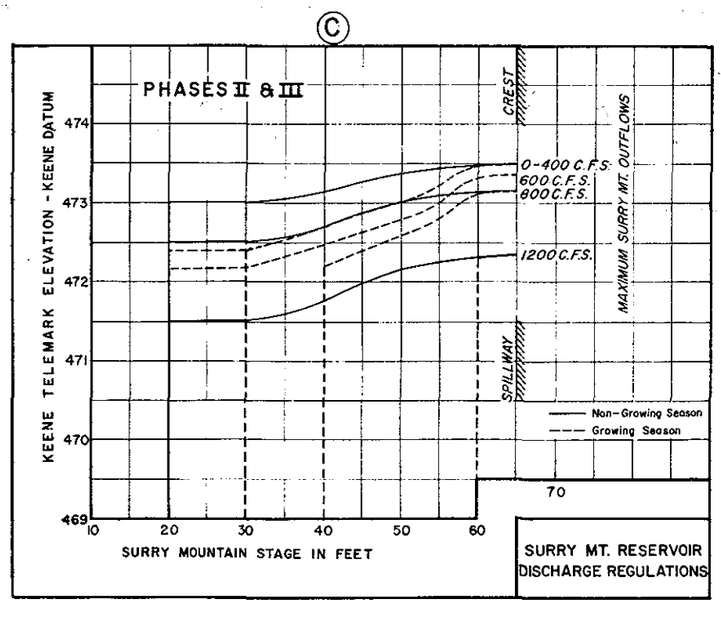
NEW ENGLAND DIVISION WALTHAM, MASS.

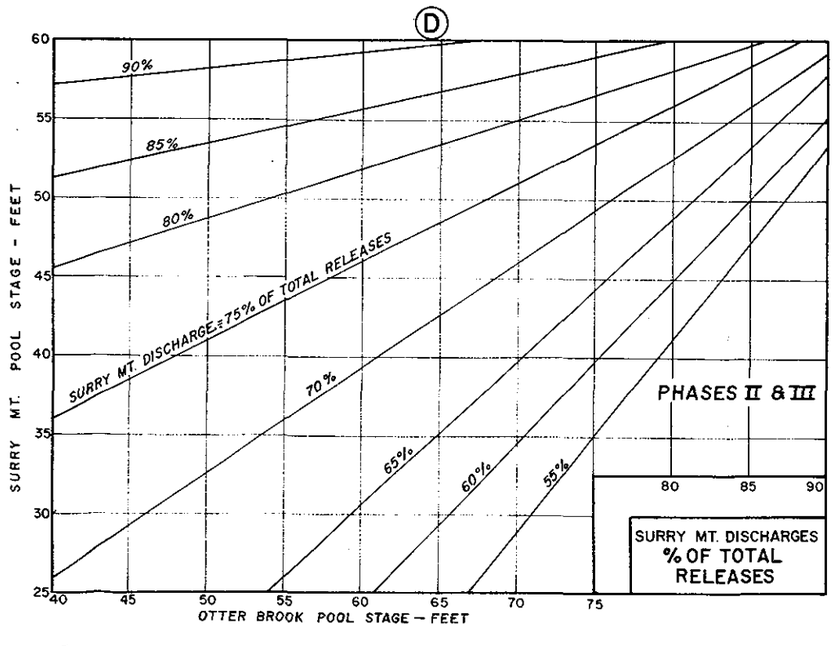
FEBRUARY 1962

PLATE NO. E-33









CONNECTICUT RIVER FLOOD CONTROL

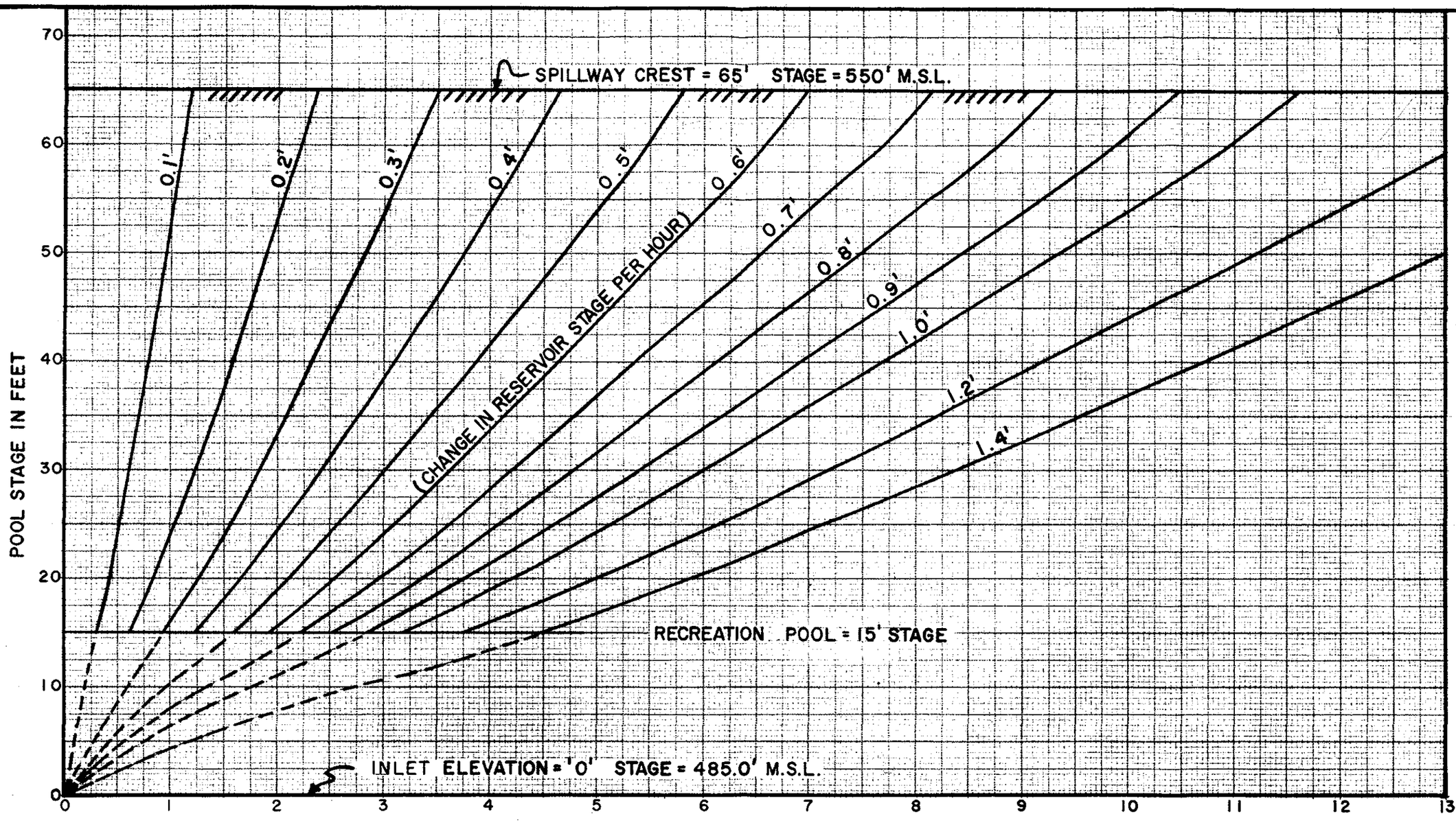
ASHUELOT RIVER BASIN

GUIDE CURVES FOR RESERVOIR REGULATION

NEW ENGLAND DIVISION WALTHAM, MASS.

FEBRUARY 1962

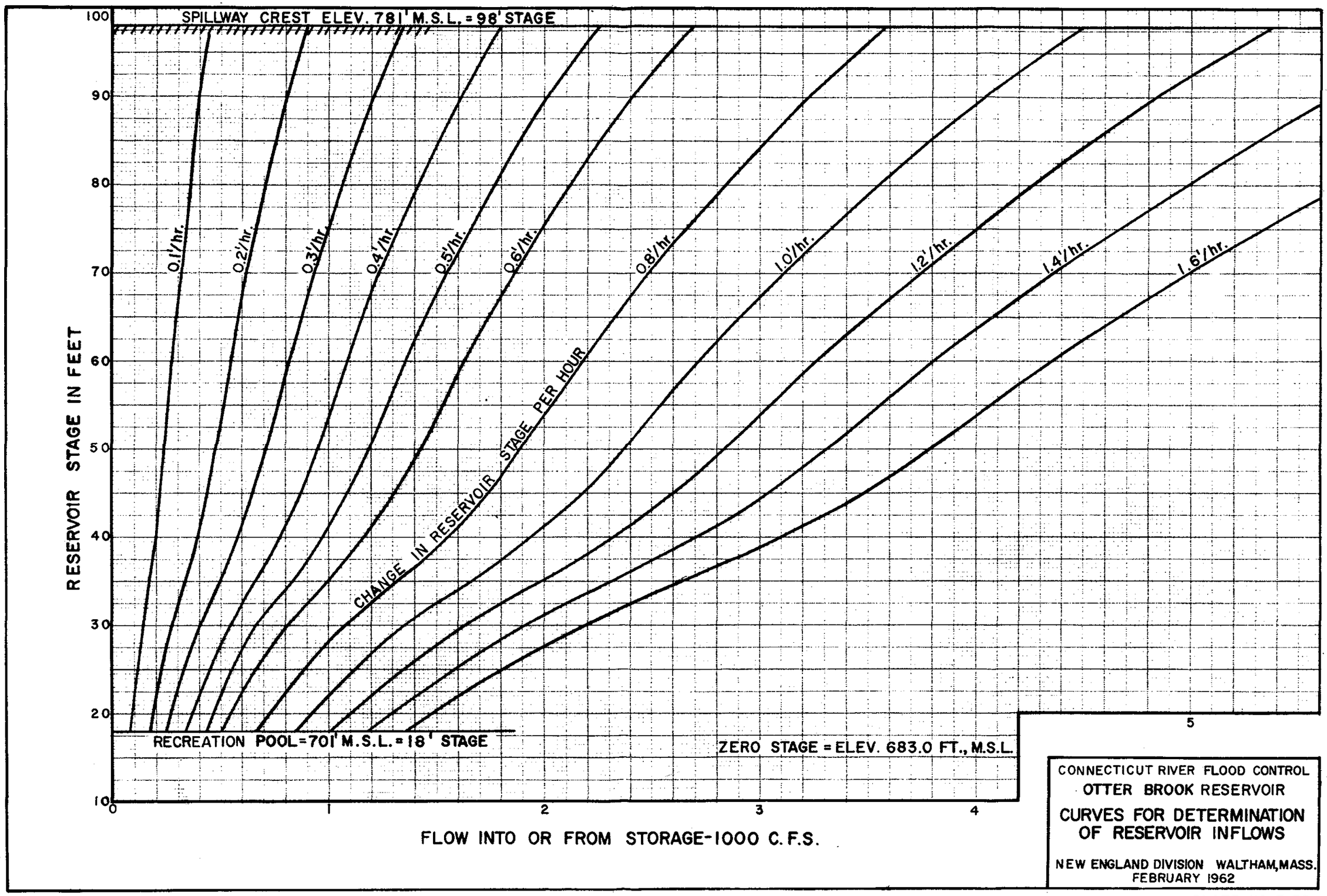
PLATE NO. E-34



FLOW INTO OR FROM STORAGE IN THOUSAND C.F.S.

CONNECTICUT RIVER FLOOD CONTROL
SURRY MOUNTAIN RESERVOIR
CURVES FOR DETERMINATION OF RESERVOIR INFLOWS
NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRUARY 1962

PLATE NO. E-35



CONNECTICUT RIVER FLOOD CONTROL

OTTER BROOK RESERVOIR

CURVES FOR DETERMINATION OF RESERVOIR INFLOWS

NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRUARY 1962

PLATE NO. E-36

LOG OF RADIO REPORTS - FLOOD CONTROL DAMS

WUA 33

SURRY MT & OTTER BK.

26 MAY, 61 — 1 JUNE, 61

Line	ITEM	SURRY MT.	OTTER BK.	SURRY MT	OTTER BK.									Line
1	Time of Observation	0800	0800	0800	0800									1
2	Precipitation (last 24 hours)	0	0	T	T									2
3	Form of Precipitation	—	—	R	R									3
4	Present Weather	CLDY	CLDY	SHOWERS	PTLY CLDY									4
5	Pool Stage	14.95	19.15	15.35	19.33									5
6	Tendency	S	F	R	S									6
7	Gate Openings	0-1.1	0-4.5-0	0-3.0	0-4.5-0									7
8	Tailwater Gage	5.36	6.47	6.40	6.67									8
9	Outflow	136	60	295	87									9
10	INDEX POINTS KEENE TELEMARK	466.5		467.1										10
11	WINCHESTER ST.													11
12														12
13														13
14														14
15														15
	REMARKS			SAMPLE										

PLATE NO. E-37

GATE OPERATION RECORD

OTTER BROOK RESERVOIR OCTOBER MONTH 1959 YEAR

DATE	HOUR	RES. STAGE Feet	GATE OPENING IN FEET*								OUTFLOW	REMARKS
			#1	#2	#3	#4	#5	#6	#7	#8	c.f.s.	
1	0830	19.0	0	4.5	0						150	At Change
24	1640	19.8	0	2.5	0						150	
24	1900	22.0	0	0	0						10	
26	0830	51.2	.5	0	0						55	
26	1350	52.35	.5	0	.5						110	
27	0830	54.20	.5	.5	.5						165	
27	1030	54.20	1.0	1.0	1.0						335	
27	1400	53.95	1.5	1.0	1.5						445	
27	1615	53.45	1.5	1.5	1.5						490	
28	0830	50.15	1.8	1.5	1.8						535	
29	0830	45.12	1.8	1.7	1.8						525	
30	0830	39.55	1.8	1.8	1.8						510	
31	0830	33.65	1.9	1.8	1.9						450	At Change
	All gates moved up and down a few tenths weekly between the 1st and the 24th. Discharge regulation started on the 24th.											

*Indicate full opened gate by "F"

SIGNED S A M P L E
OPERATOR

DATE

FORM FE8 60 90 Replaces Ned Form 90 of Jan 53 and Ned Forms 91 and 101 which are obsolete

PLATE NO. E-38

NED FORM 423
5 MAY 58

REGULATION OF SURRY MOUNTAIN AND OTTER BROOK RESERVOIRS
LOG OF REPORTS AND INSTRUCTIONS

TIME OF REPORT	SURRY MOUNTAIN RESERVOIR						OTTER BROOK RESERVOIR							KEENE TELEMARK		MISCELLANEOUS DISCHARGE DATA				RAINFALL	
	RESERVOIR POOL		GATE OPEN'GS.		OUTFLOW		RESERVOIR POOL		GATE OPENINGS			OUTFLOW									
	HOUR	STAGE	1	2	T.W.	C.F.S.	HOUR	STAGE	1	2	3	T.W.	C.F.S.	HOUR	ELEVATION	LOCATION	HOUR	STAGE	C.F.S.	LOCATION	HOUR INCHES
	0400	51.5	1.0	0			0400	76.4	0	0	0			0500	473.2						
4-6-60	0700	52.25	1.0	0	6.30	213	0700	77.3	0	0	0	5.9	11	0700	473.0	WINCHESTER ST.	0630	6.85			
0715																					
					INSTRUCT TO OPEN SURRY TO 1.0'-1.0', CALL BACK AT 1100.																	
	0900	52.60	1.0	1.0			0800	77.6	0	0	0			0900	472.9						
1100	1100	53.0	1.0	1.0	7.07	435	1100	78.45	0	0	0	5.92	12	1100	472.7	WINCHESTER ST.	1030	6.55			
		INSTRUCT TO OPEN SURRY TO 1.5'-1.5' AND AT 1300 OPEN TO 2.0'-2.0'																			
					OPEN OTTER BK. TO 0.5'-0-0.5' AND AT 1300										OPEN TO 1.0'-0-1.0'		CALL BACK AT 1500					
4-6-60	1400	53.40	2.0	2.0			1400	79.10	1.0	0	1.0										
1500	1500	53.5	2.0	2.0	8.23	840	1500	79.25	1.0	0	1.0	7.50	268			CALL BACK AT 2000.					
	1600	53.6					1600	79.4						1700	472.7						
	1800	53.8					1800	79.7						1900	472.7						
2000	2000	54.0	2.0	2.0	8.28	857	2000	80.0	1.0	0	1.0	7.52	274	2000	472.7	WINCHESTER ST	1945	7.1			
		INSTRUCT TO OPEN SURRY TO 2.3'-2.2'														CALL BACK AT 0800.					

SAMPLE

PLATE NO. E-39

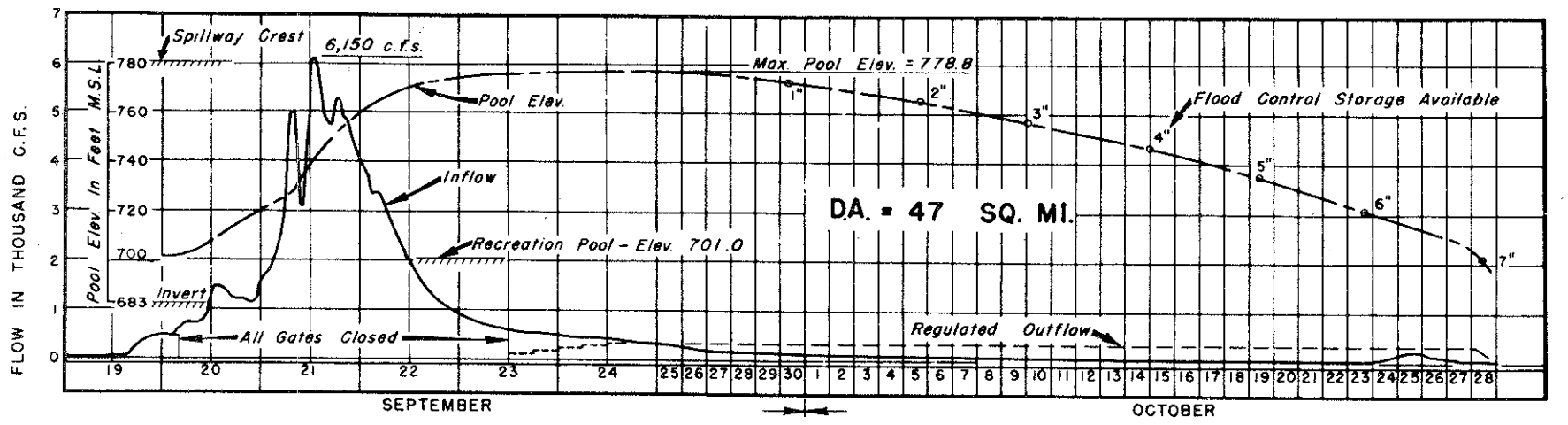
NED FORM 102
15 Nov. 1951

RESERVOIR REGULATION
COMPUTATION OF INFLOW

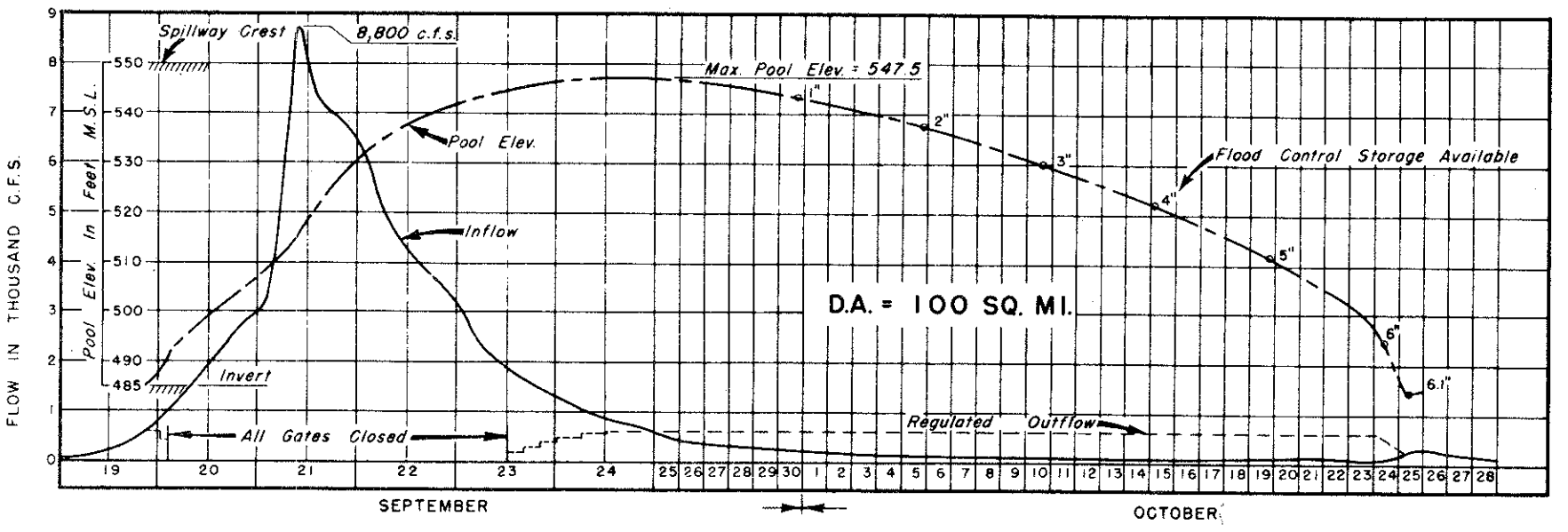
Flood of OCT 1959

Reservoir SURRY MT. By SAMPLE Date 26 OCT 1959

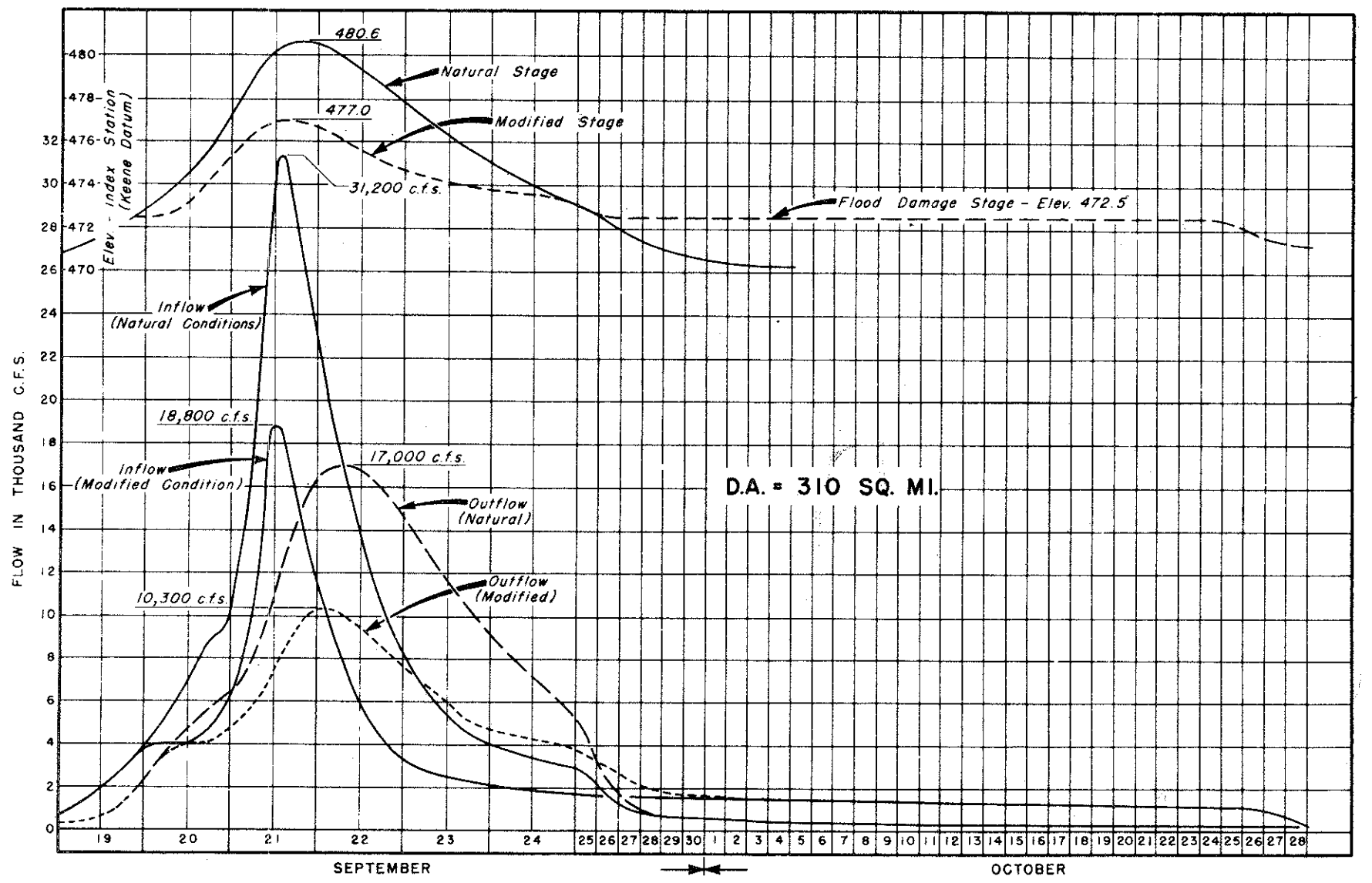
TIME	RES. STAGE Feet	CHANGE IN RES. STAGE Feet per hour Observed	CHANGE IN RES. STAGE Feet per hour Adjusted	FLOW into/from STORAGE c.f.s.	OUTFLOW c.f.s.	TOTAL INFLOW (5) + (6) c.f.s.	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
9-24-59							
2200	21.0				35		
	21.75	1.5	0.75	3360		3395	
2400	22.5				35		
	23.25	1.5	0.75	3540		3575	
9-25-59							
0200	24.0				35		
	24.7	1.4	0.7	3520		3555	
0400	25.4				35		
	26.0	1.2	0.6	3150		3185	
0600	26.6				35		
	27.25	1.3	0.65	3550		3585	
0800	27.9				35		
	28.45	1.1	0.55	3100		3135	
1000	29.0				35		
	29.45	0.9	0.45	2640		2675	
1200	29.9				35		
	30.45	1.1	0.55	3320		3355	
1400	31.0				35		
	31.4	0.8	0.4	2480		2515	
1600	31.8				35		
	32.15	0.7	0.35	2220		2255	
1800	32.5				35		
	32.85	0.7	0.35	2260		2295	
2000	33.2				35		
	33.55	0.7	0.35	2310		2345	
2200	33.9				35		
	34.2	0.6	0.3	1750		1785	
2400	34.5				35		
	34.75	0.5	0.25	1690		1725	
9-26-59							
0200	35.0				35		
	35.25	0.5	0.25	1720		1755	
0400	35.5				35		
	35.75	0.5	0.25	1740		1775	
0600	36.0				35		
	36.25	0.5	0.25	1760		1795	
0800	36.5				35		
	36.7	0.4	0.2	1430		1465	
							PLATE NO. E-40



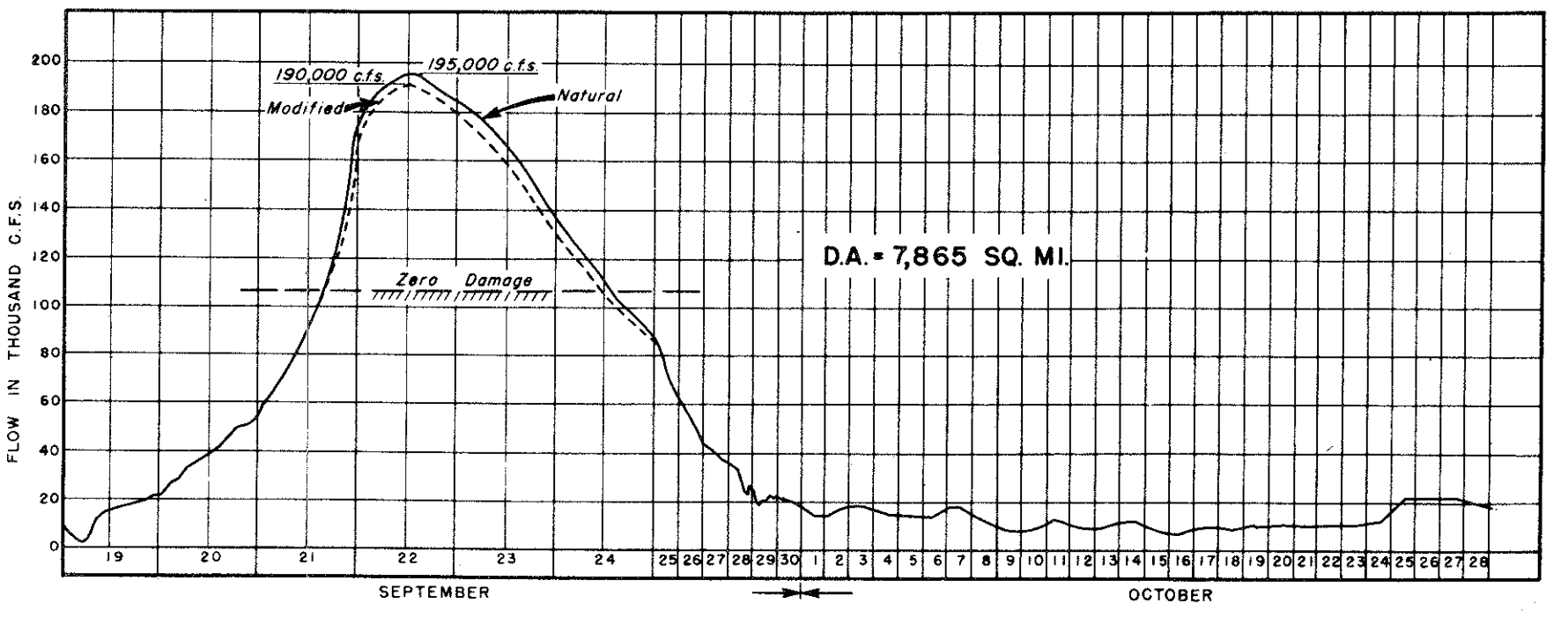
OTTER BROOK AT OTTER BROOK RESERVOIR



ASHUELOT RIVER AT SURRY MT. RESERVOIR



ASHUELOT RIVER AT KEENE, NEW HAMPSHIRE



CONNECTICUT RIVER AT MONTAGUE CITY, MASSACHUSETTS

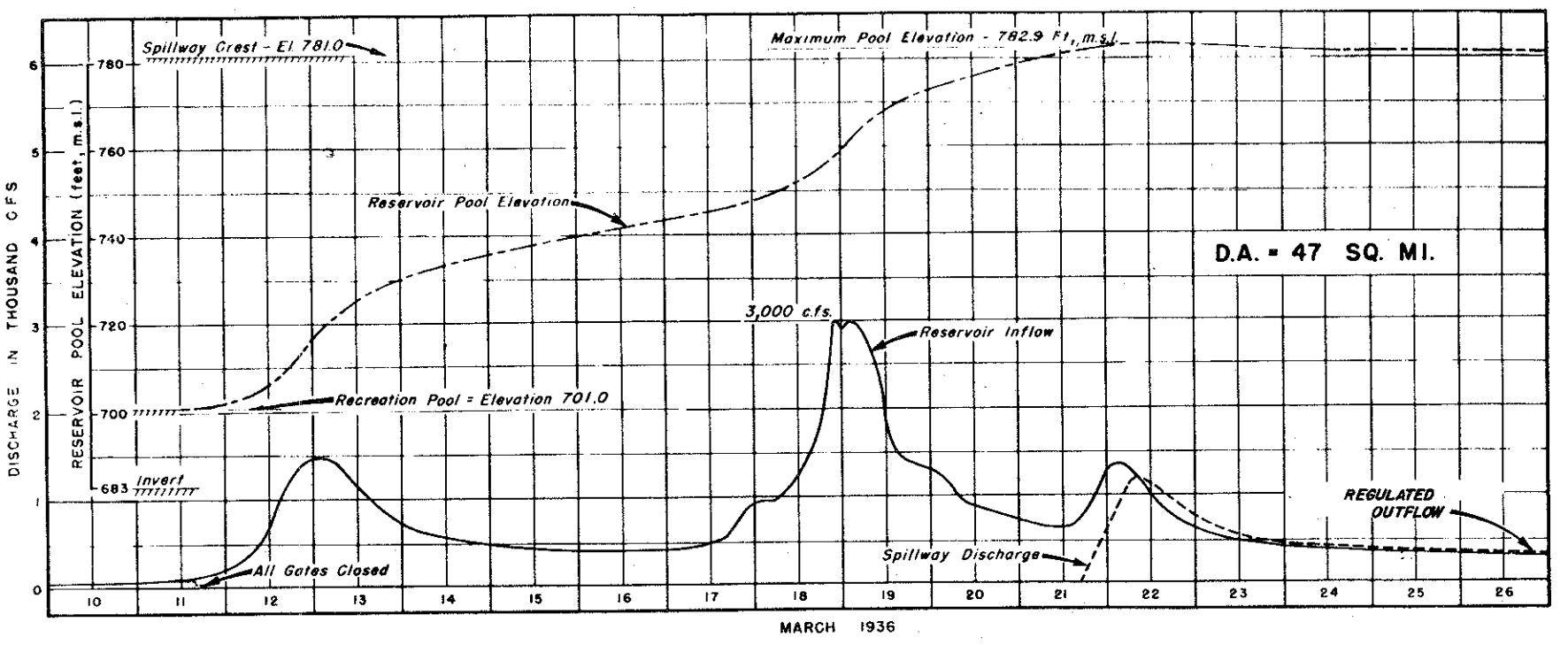
CONNECTICUT RIVER FLOOD CONTROL
ASHUELOT RIVER BASIN

EFFECT OF SURRY MOUNTAIN AND OTTER BROOK RESERVOIRS ON FLOOD OF SEPTEMBER 1938

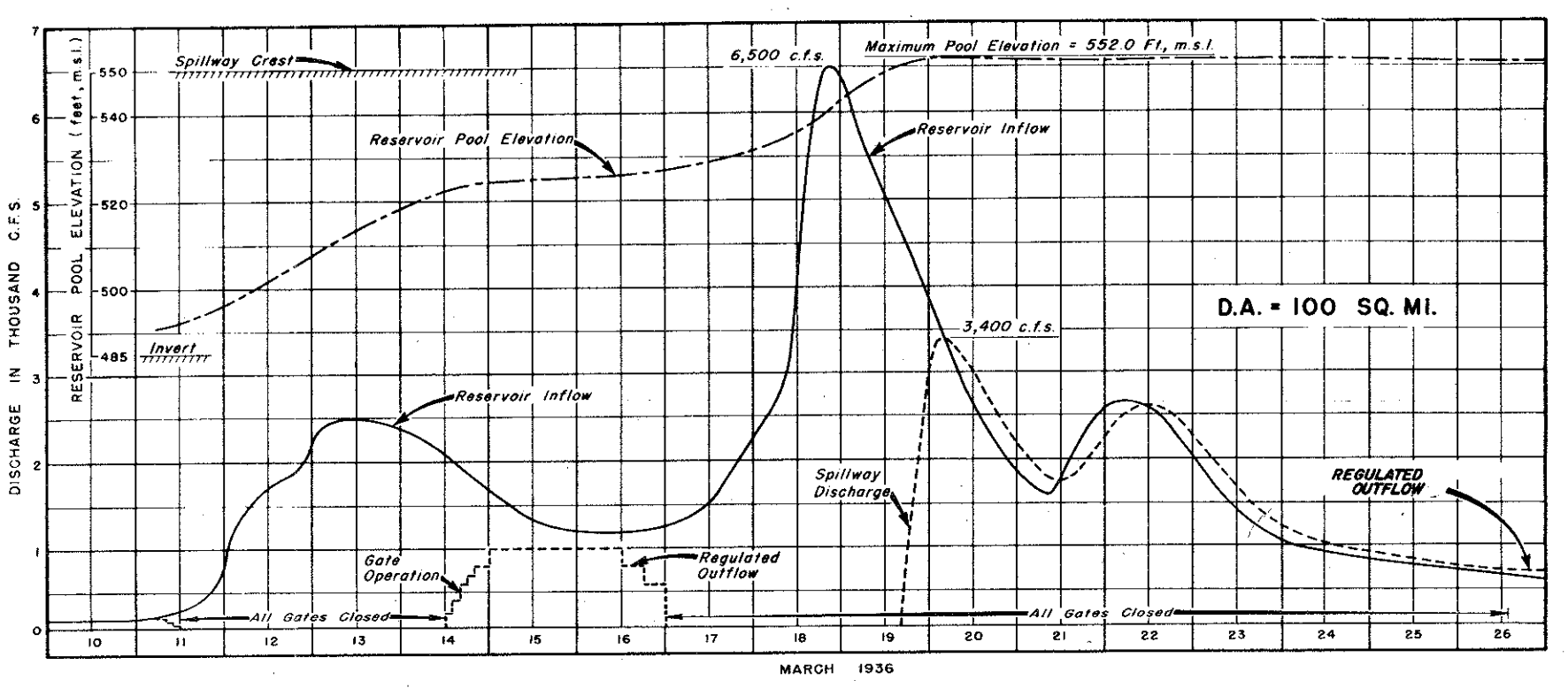
NEW ENGLAND DIVISION, WALTHAM, MASS.

DECEMBER 1961

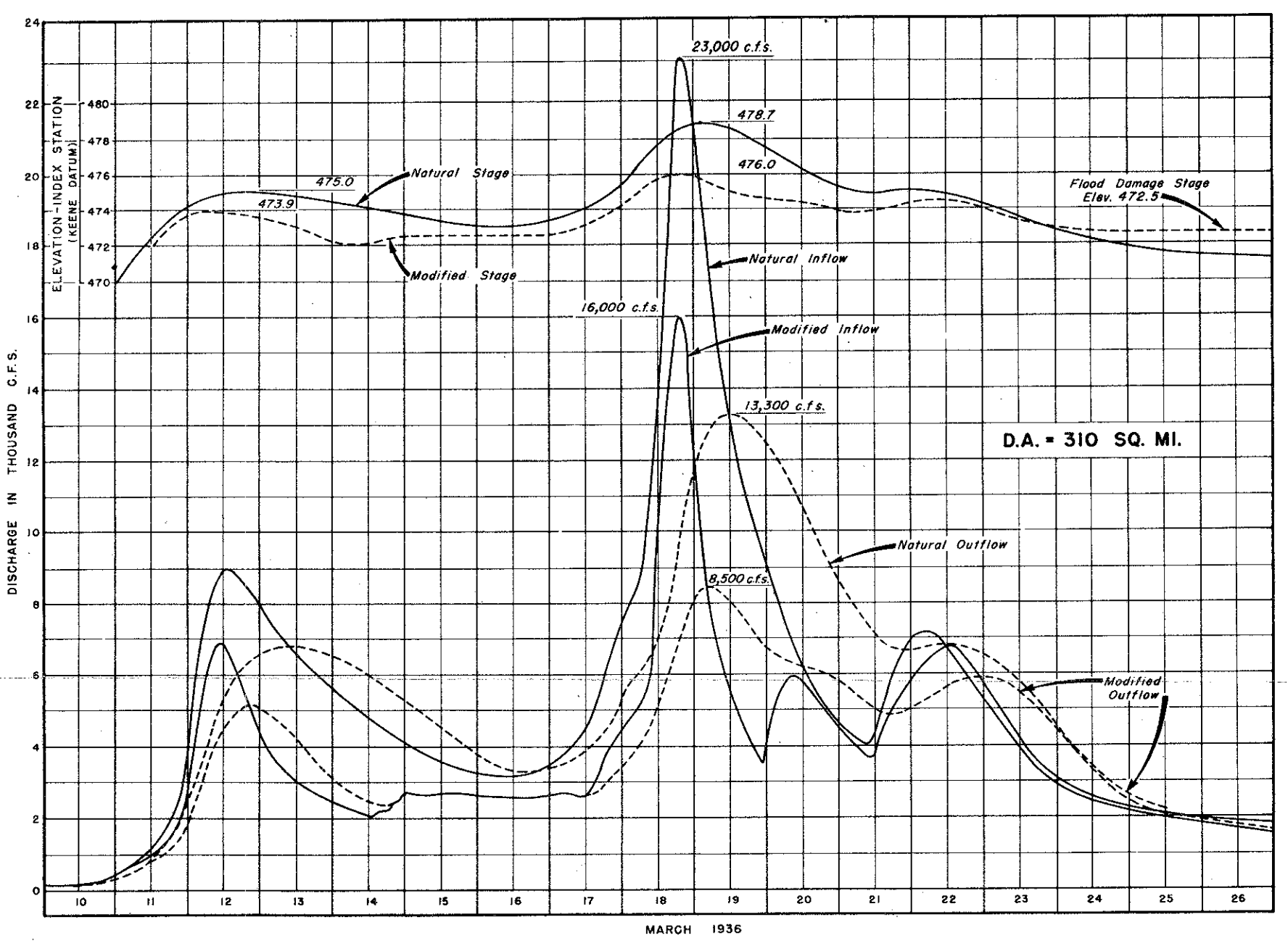
PLATE NO. E-41



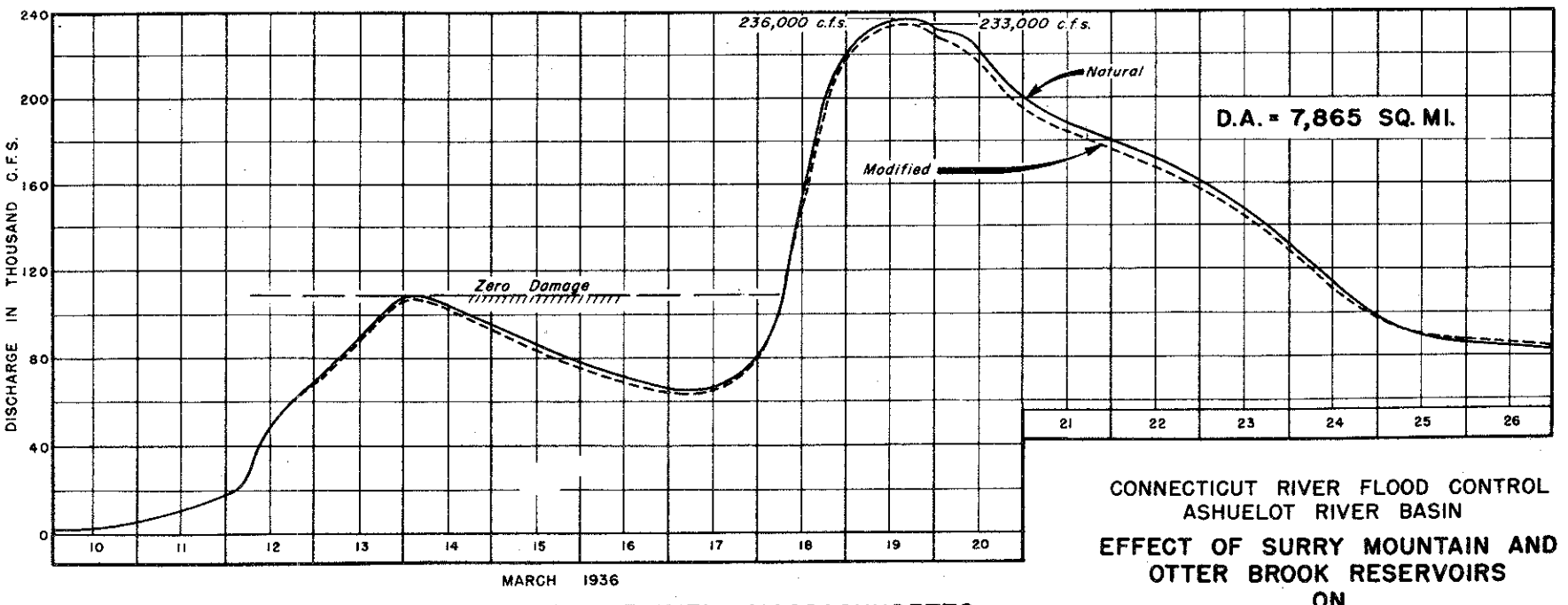
OTTER BROOK AT OTTER BROOK RESERVOIR



ASHUELOT RIVER AT SURRY MT. RESERVOIR



ASHUELOT RIVER AT KEENE, NEW HAMPSHIRE



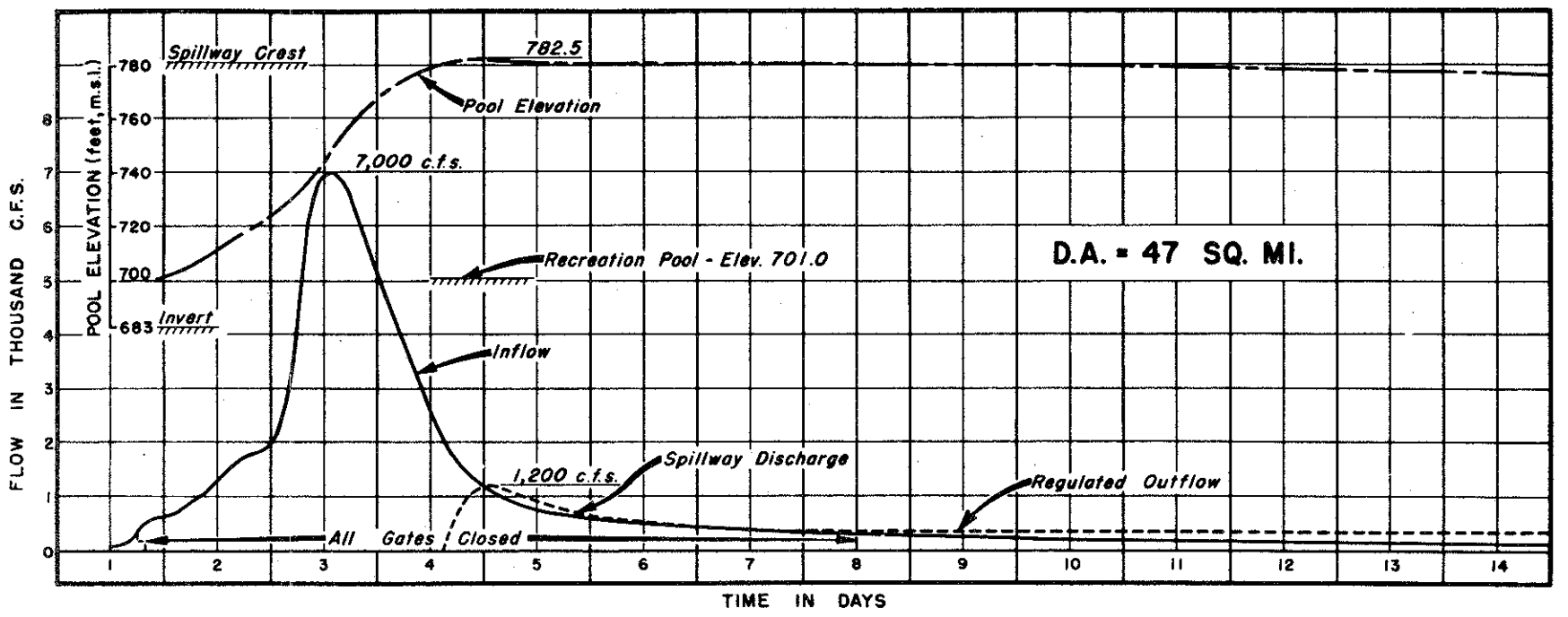
CONNECTICUT RIVER AT MONTAGUE CITY, MASSACHUSETTS

CONNECTICUT RIVER FLOOD CONTROL
ASHUELOT RIVER BASIN

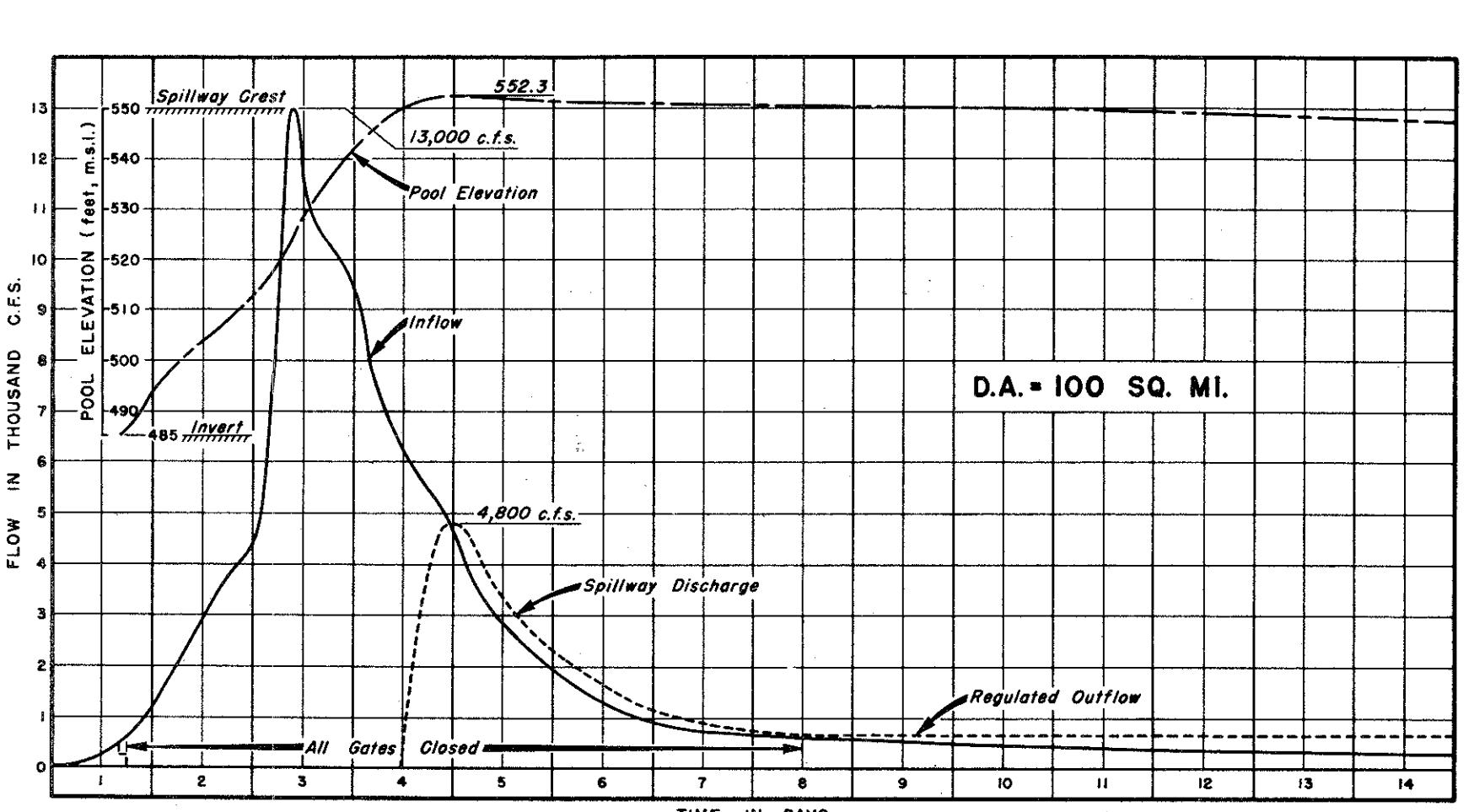
EFFECT OF SURRY MOUNTAIN AND OTTER BROOK RESERVOIRS ON FLOOD OF MARCH 1936

NEW ENGLAND DIVISION, WALTHAM, MASS.
DECEMBER 1961

PLATE NO. E-42



OTTER BROOK AT OTTER BROOK RESERVOIR



ASHUELOT RIVER AT SURRY MT. RESERVOIR

ASHUELOT RIVER AT KEENE, NEW HAMPSHIRE

CONNECTICUT RIVER FLOOD CONTROL
ASHUELOT RIVER BASIN

EFFECT OF SURRY MOUNTAIN AND OTTER BROOK RESERVOIRS ON STANDARD PROJECT FLOOD

NEW ENGLAND DIVISION, WALTHAM, MASS.
DECEMBER 1961

PLATE NO. E-43

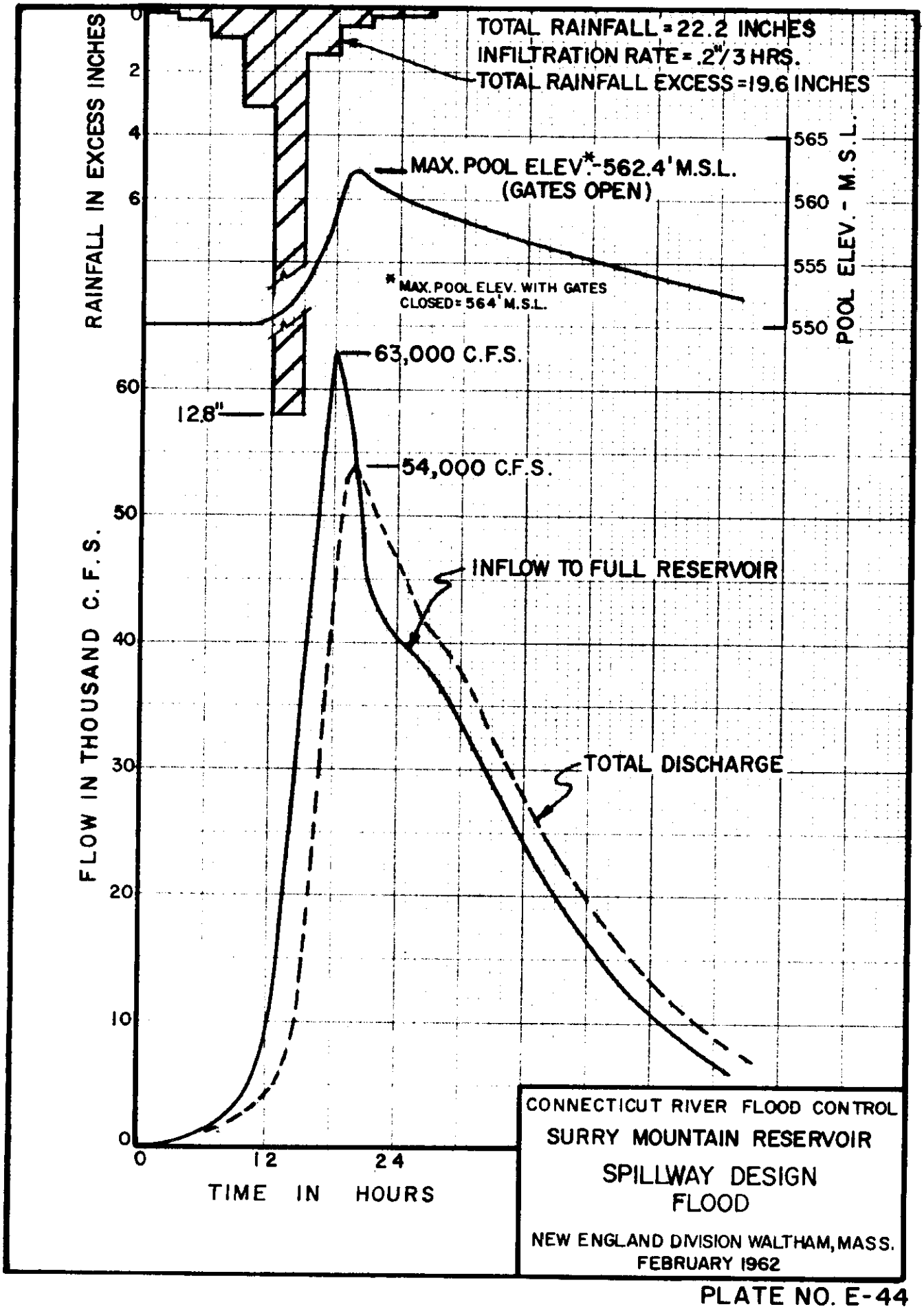
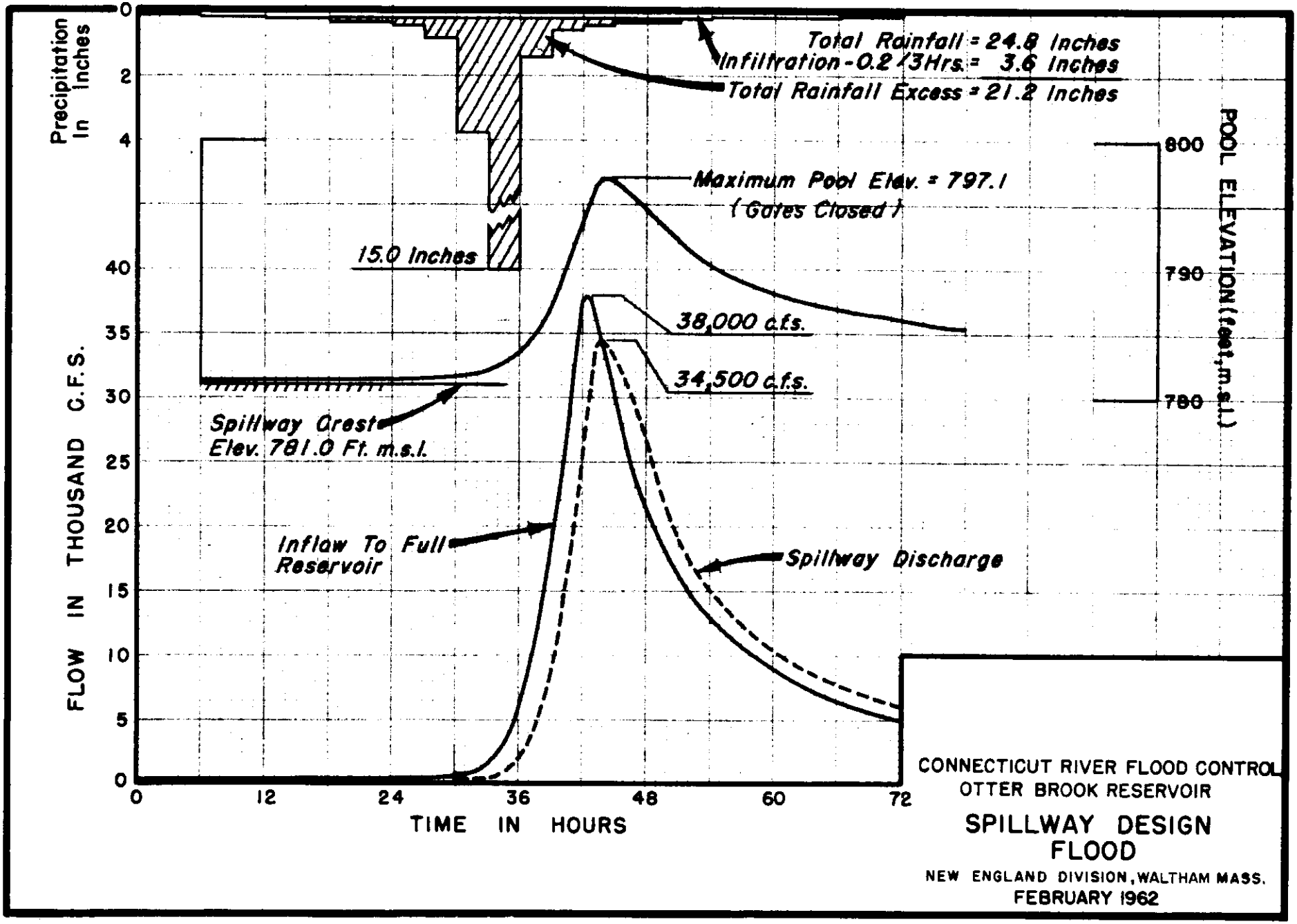

TOTAL RAINFALL = 22.2 INCHES
INFILTRATION RATE = .2"/3 HRS.
TOTAL RAINFALL EXCESS = 19.6 INCHES
MAX. POOL ELEV.*-562.4' M.S.L. (GATES OPEN)
* MAX. POOL ELEV. WITH GATES CLOSED = 564' M.S.L.
63,000 C.F.S.
54,000 C.F.S.
12.8"
INFLOW TO FULL RESERVOIR
TOTAL DISCHARGE
RAINFALL IN EXCESS INCHES
FLOW IN THOUSAND C.F.S.
POOL ELEV. - M.S.L.
TIME IN HOURS
0
2
4
6
10
20
30
40
50
60
550
555
560
565
0
12
24
CONNECTICUT RIVER FLOOD CONTROL
SURRY MOUNTAIN RESERVOIR
SPILLWAY DESIGN FLOOD
NEW ENGLAND DIVISION WALTHAM, MASS.
FEBRUARY 1962

PLATE NO. E-44



CONNECTICUT RIVER FLOOD CONTROL
OTTER BROOK RESERVOIR

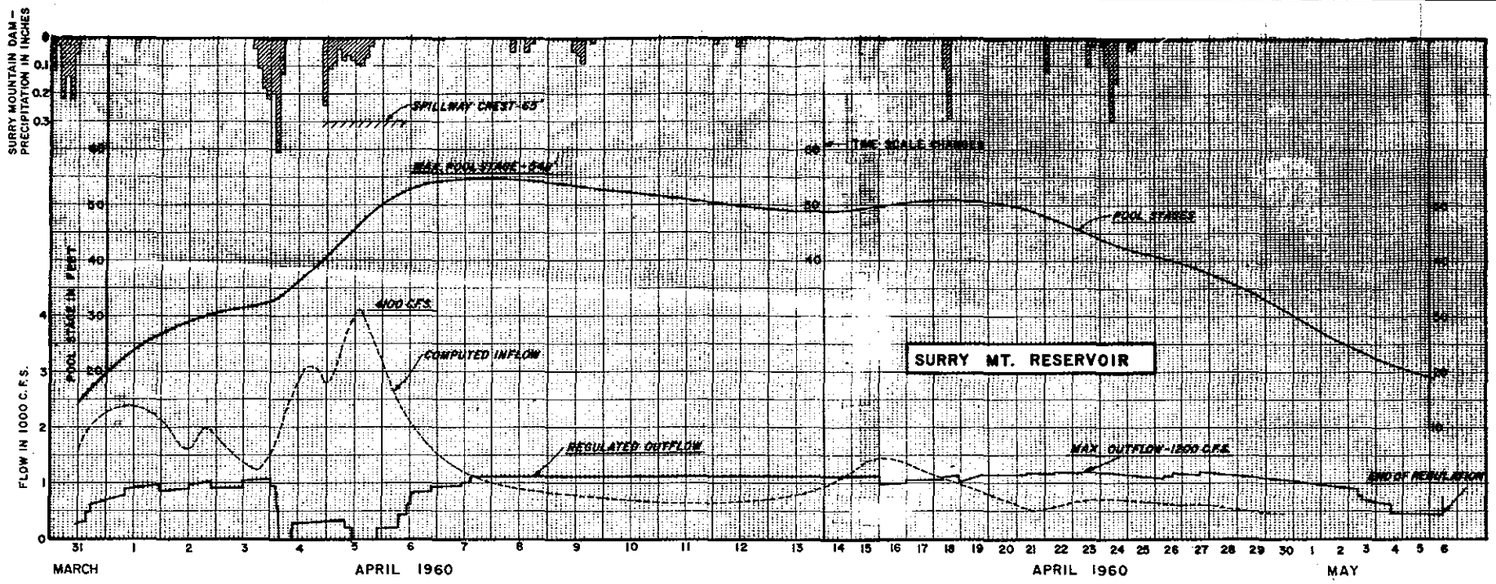
SPILLWAY DESIGN FLOOD

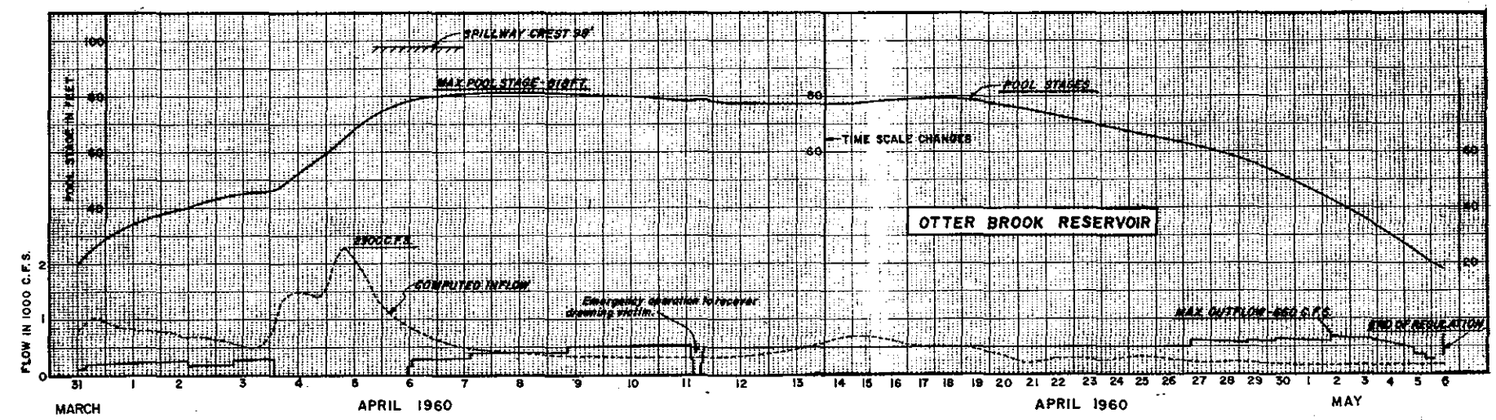
NEW ENGLAND DIVISION, WALTHAM MASS.
FEBRUARY 1962

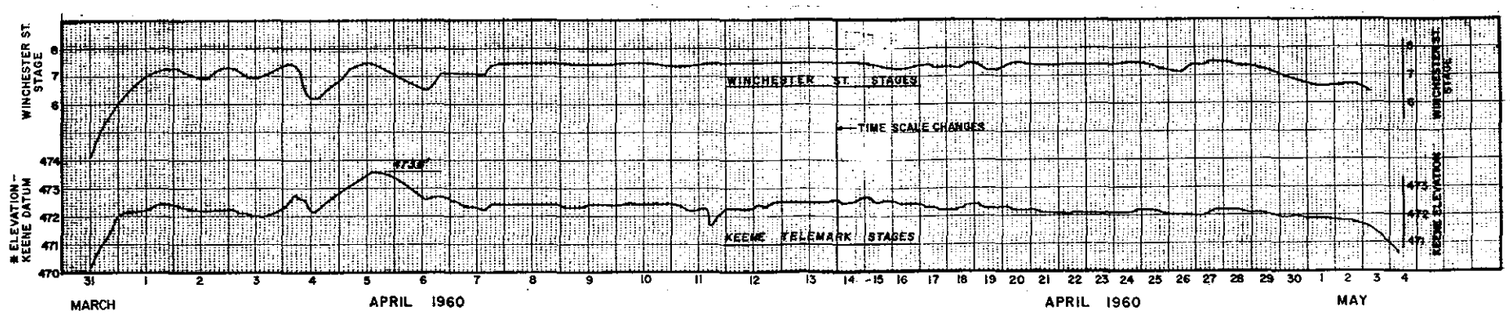
PLATE NO. E-45

CORPS OF ENGINEERS

U. S. ARMY







*–KEENE DATUM IS 5.3' ABOVE M.S.L.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY | TR. BY M.W.B. | CK. BY

PROJECT ENGINEER

CHIEF, SECTION

SUBMITTED BY

CHIEF, PLANS & EFTS. BRANCH

CONNECTICUT RIVER FLOOD CONTROL

EFFECT OF SURRY MOUNTAIN AND OTTER BROOK RESERVOIRS ON THE APRIL 1960 FLOOD

ASHUELOT RIVER NEW HAMPSHIRE

APPROVED DATE FEB. 1962

CHIEF ENGINEERING DIV.

SCALE

DRAWING NUMBER NEC. 800 CN ENG-10-018-

SHEET

PLATE NO. E-46